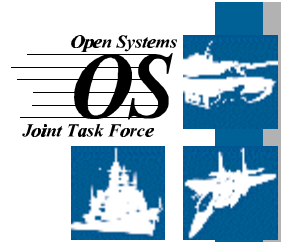




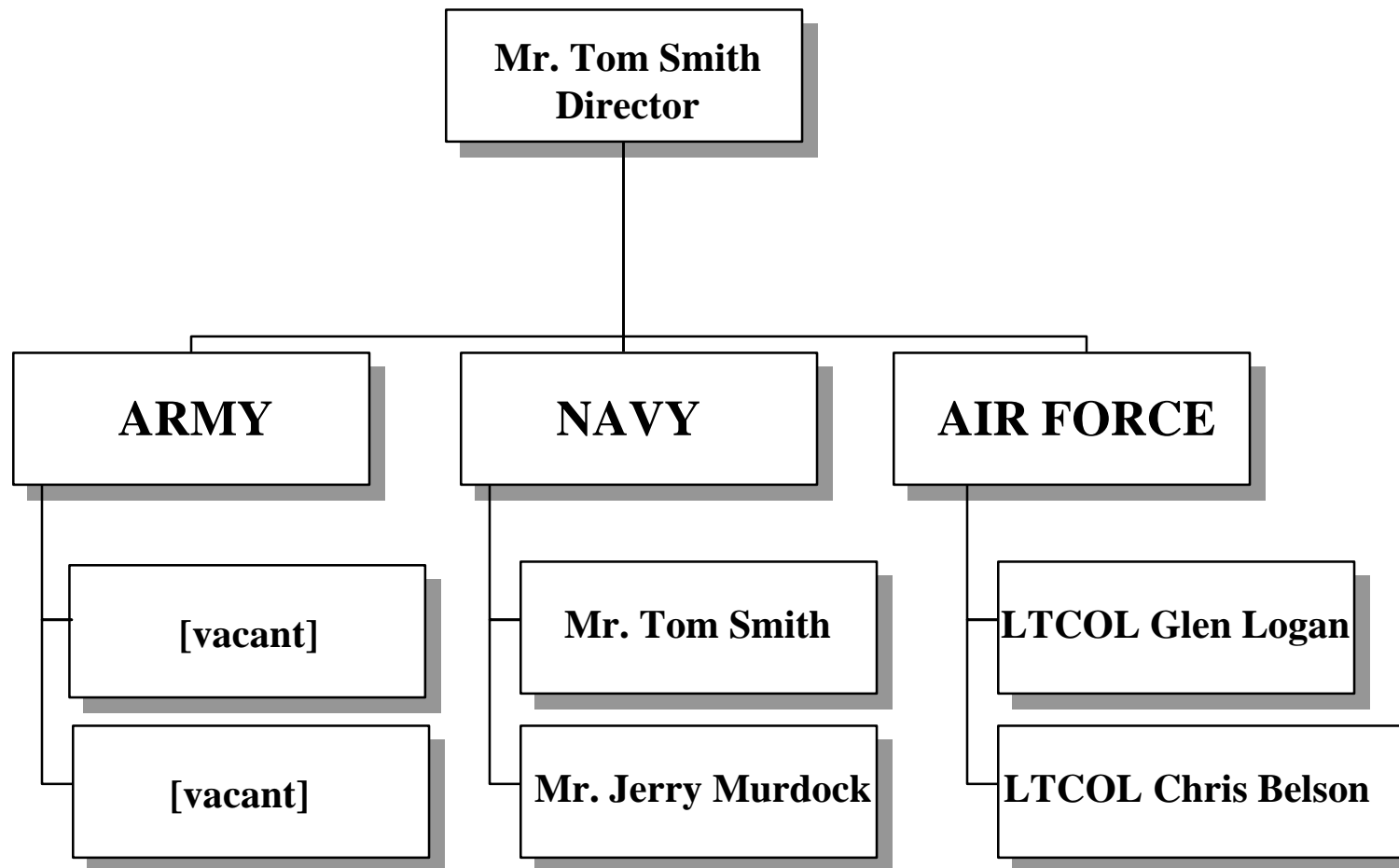
Strategic Issues in Major Systems Acquisition - “Open Systems”

OS-JTF Mission

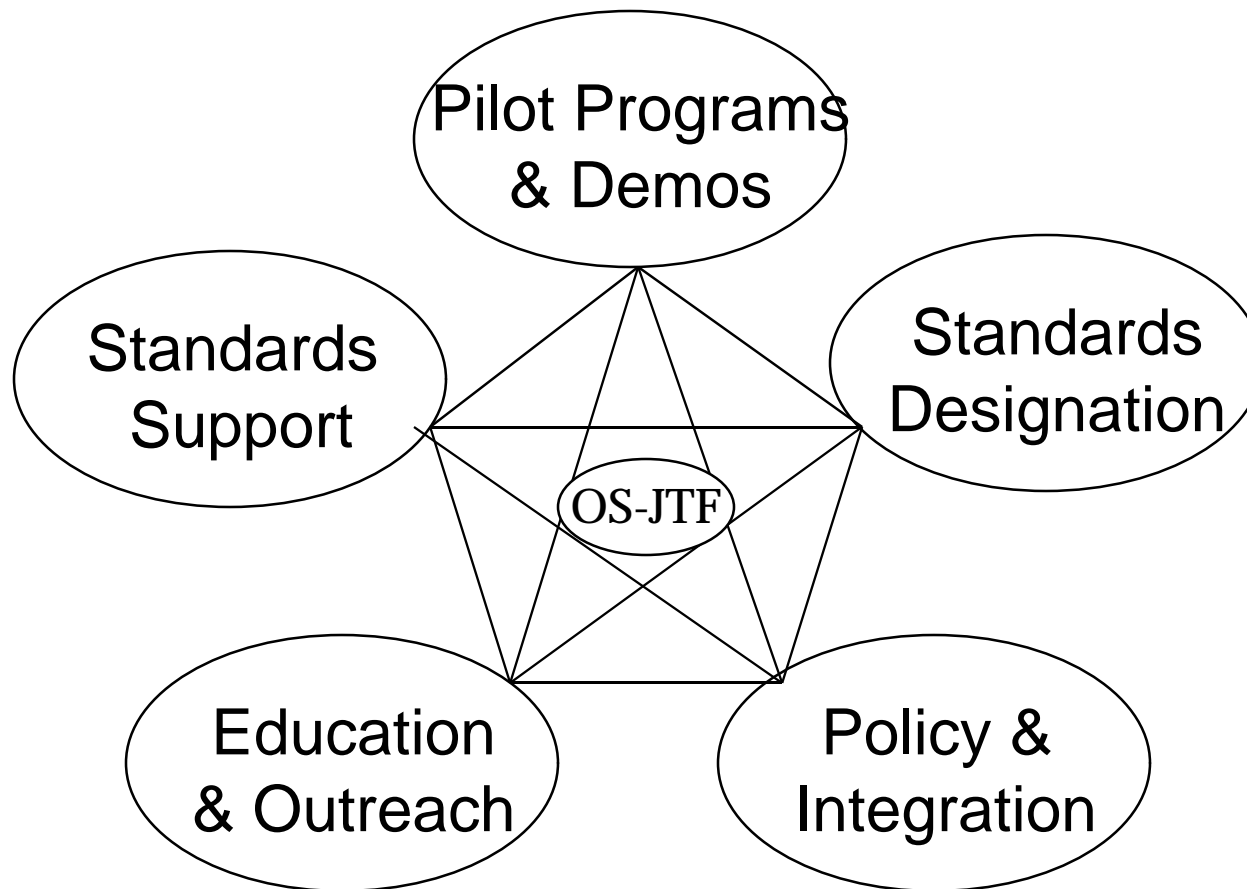


- Policy
 - Open Systems Approach to be used for acquisition of weapons system electronics
- Task Force Mission
 - Champion the establishment of an open systems approach (OSA) as the preferred technical approach and business strategy for the acquisition of all weapon systems.
- Scope
 - Weapons systems and platforms
 - Not C3I systems, communications networks, nor non-real time data processing functions
 - Hardware, software, tools and architecture
 - Electrical, mechanical, thermal, etc.

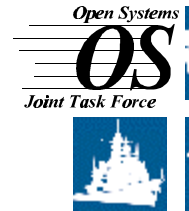
OS-JTF Staff



OS-JTF Activities



The Acquisition Environment



Unique, Closed Weapons Systems Designs

Cost Too Much to Develop

Cost Too Much to Support

Cost Too Much to Modify

Can Not Readily Employ New Technologies

Inter-operation Is Less Than Desirable

Longer Weapon System Life

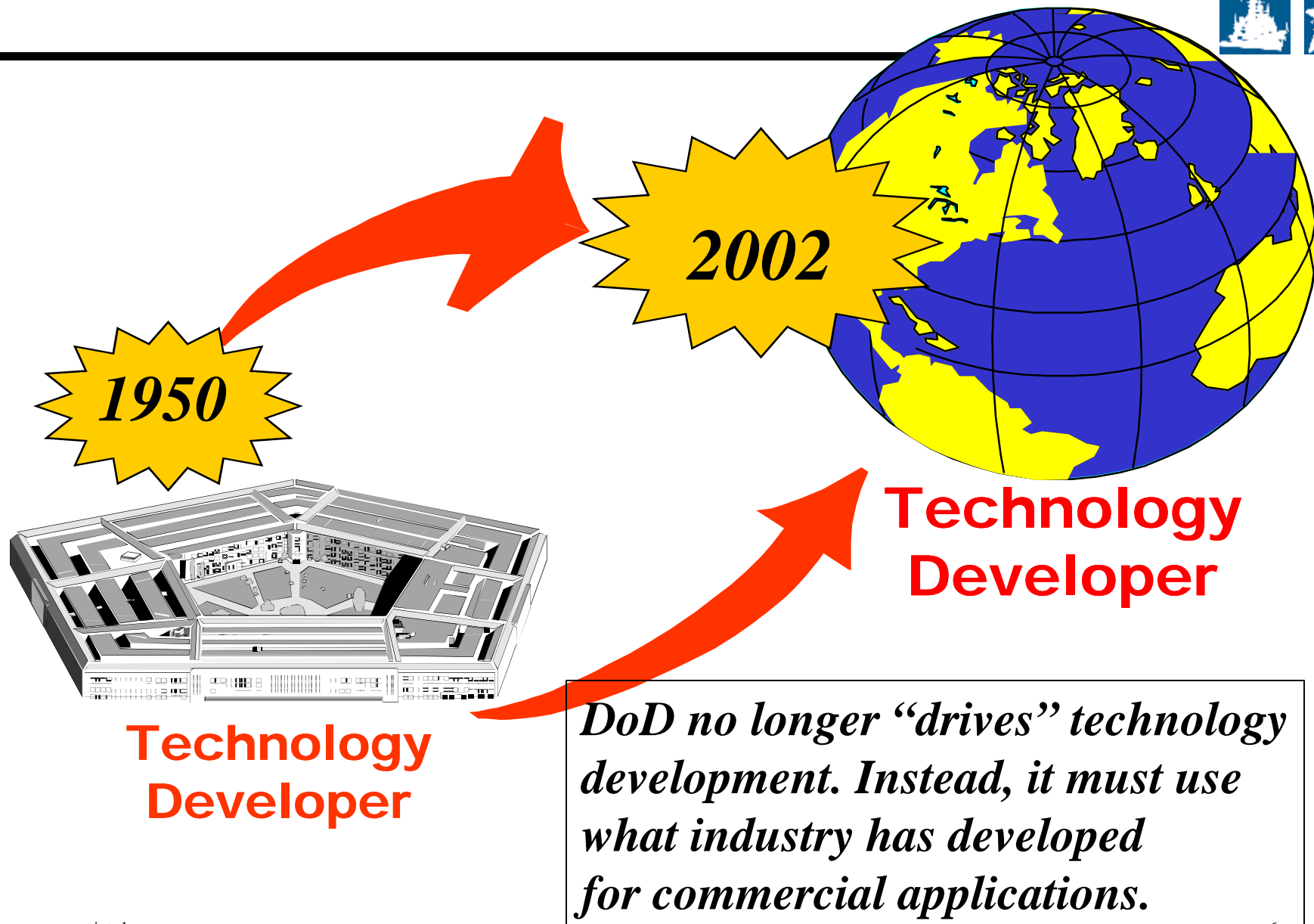
Reduced DOD Budget

Increased Dominance of Commercial Market

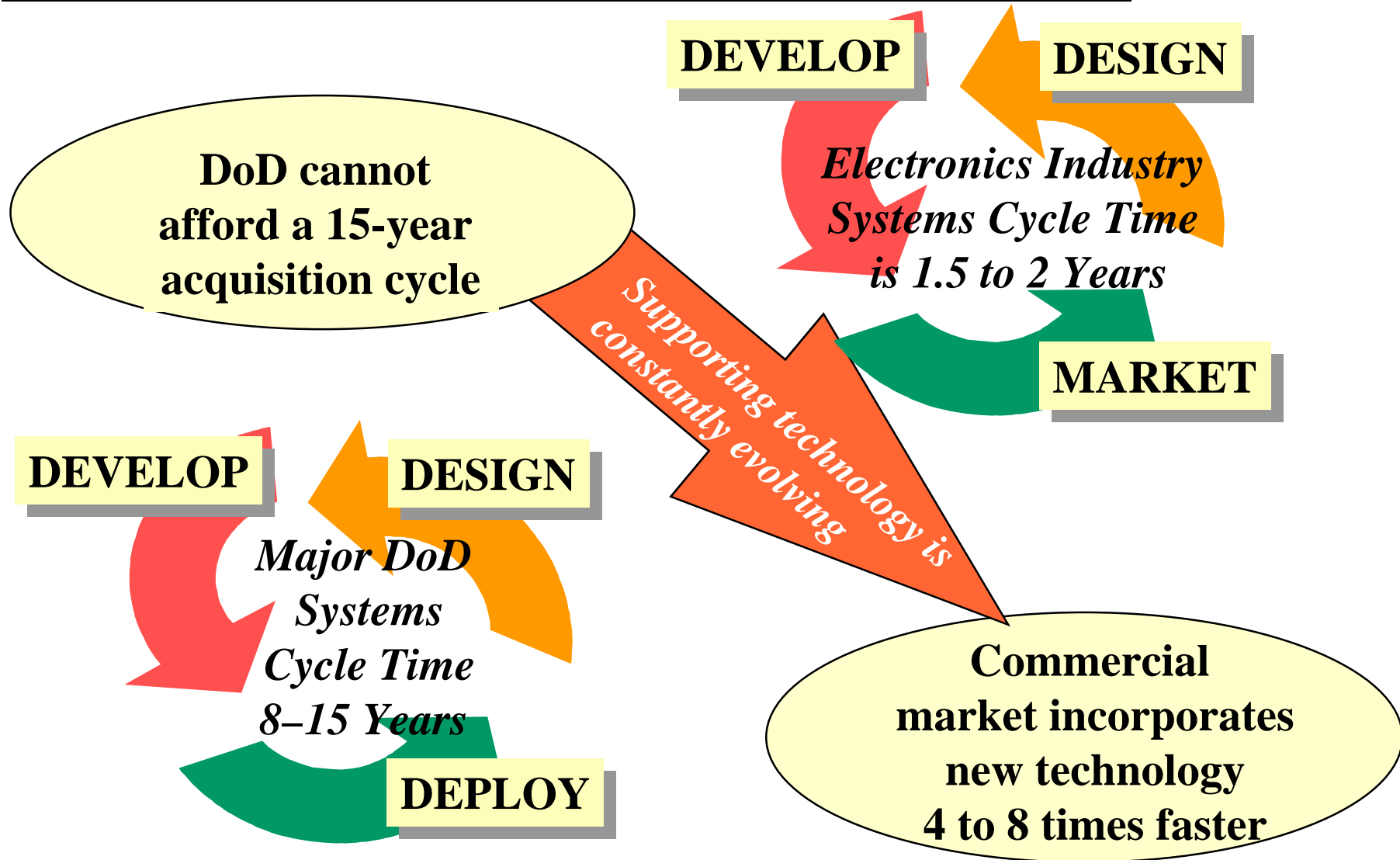
Shortened Technology Cycle Time



Commercial Dominance



Shorter Commercial Product Life Times



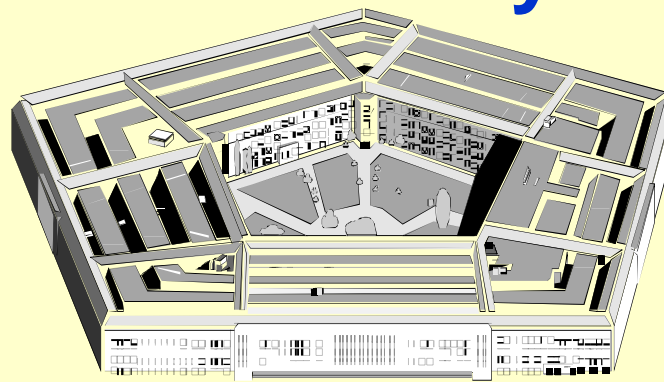
Systems Often Have 30-50 Year Service Lifetimes



DoD's Open Systems Vision



DoD uses open systems to leverage commercial products and practices in order to field superior warfighting capability more quickly and more affordably.



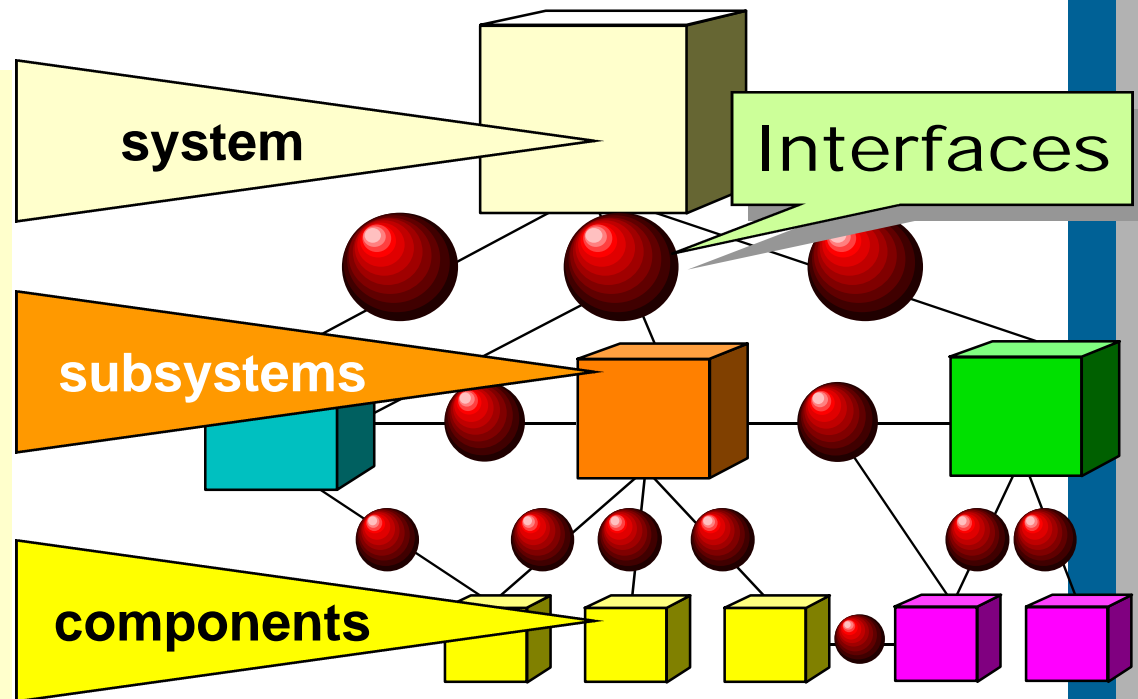
Definitions

A **system** -
is a collection of
interacting...

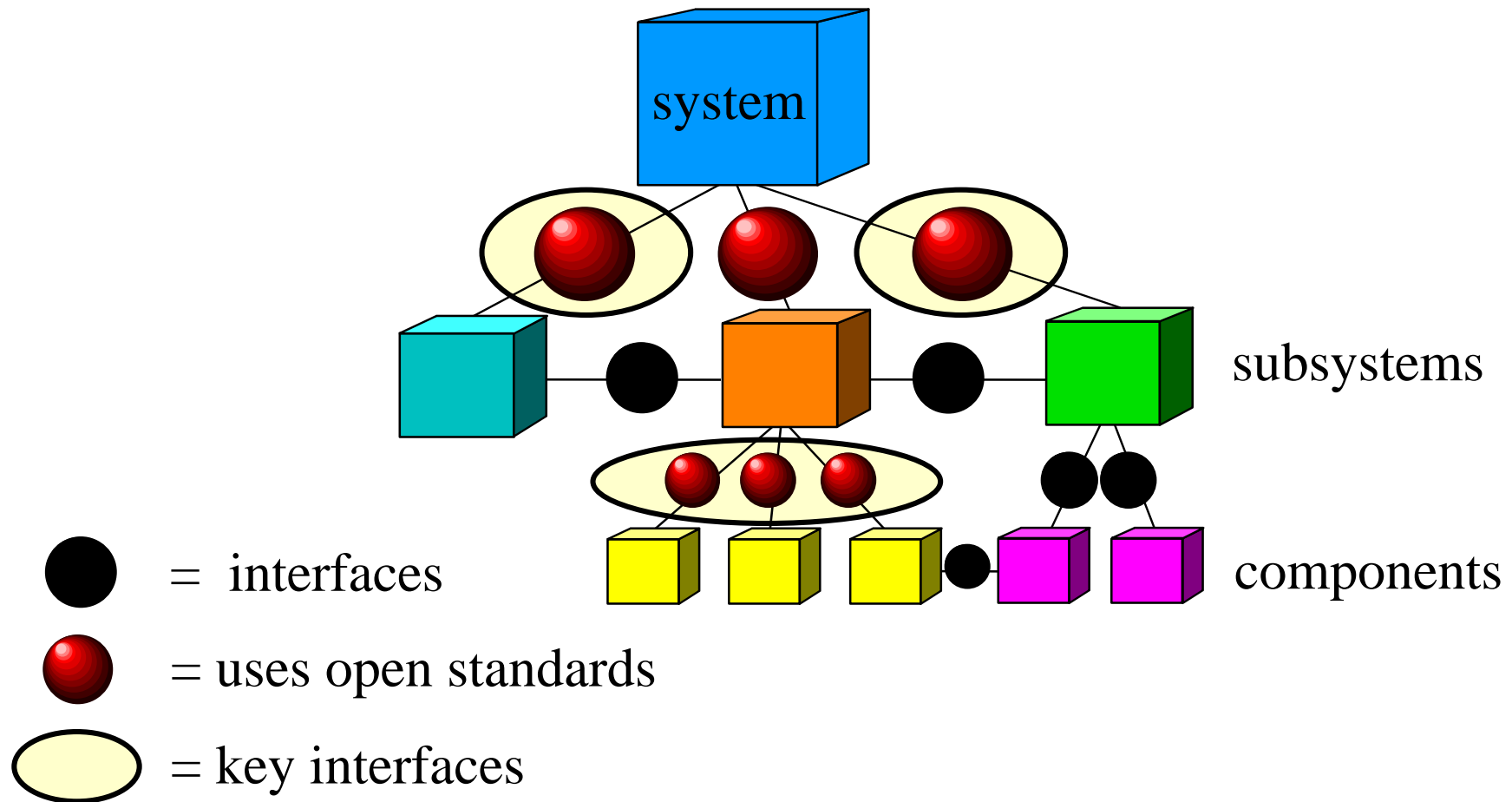
...**subsystems** -
which are collections
of interacting...

...**components** -
either hardware,
software, or human, ...

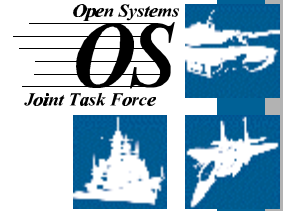
...that are connected by **interfaces** -
to support the interchange of information, activity, or material
essential to the functioning of the system.



Key Interfaces



Definition of Open Systems

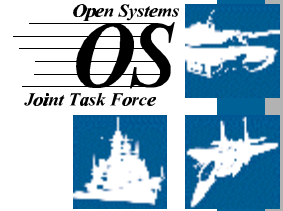


A system that implements sufficient open standards for interfaces, services, and supporting formats to enable properly engineered components to be utilized across a wide range of systems with minimal changes, to interoperate with other components on local and remote systems, and to interact with users in a style that facilitates portability. An open system is characterized by the following:

well defined, widely used, non-proprietary interfaces/protocols, and use of standards which are developed/adopted by recognized standards bodies or the commercial market place, and definition of all aspects of system interfaces to facilitate new or additional systems capabilities for a wide range of applications, and explicit provision for expansion or upgrading through the incorporation of additional or higher performance elements with minimal impact on the system.

(OS-JTF 1998)

Open Systems Approach



- An integrated business and technical strategy that employs a modular design and, where appropriate, defines key interfaces using widely supported, consensus-based standards that are published and maintained by a recognized industry standards organization.

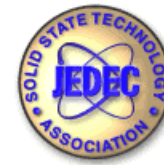
Open Standards

Open Systems
OS
Joint Task Force

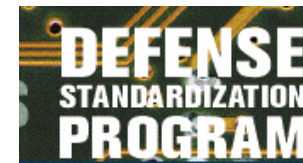


Open Standards Are:

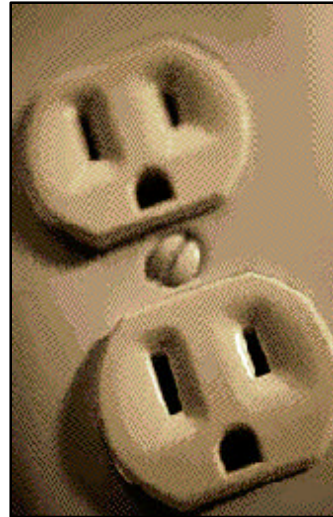
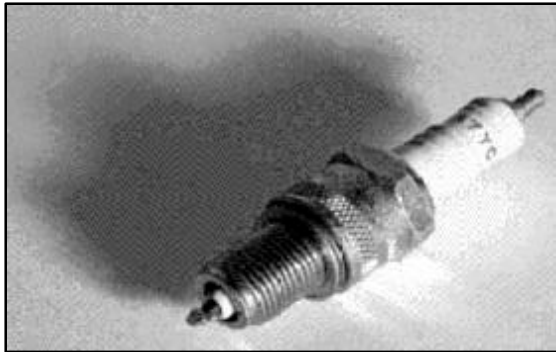
- Publicly Available
- Well Defined
- Consensus Based
(Non Government Standards Body)



ASME



Open Systems Concepts— Open Interface Examples



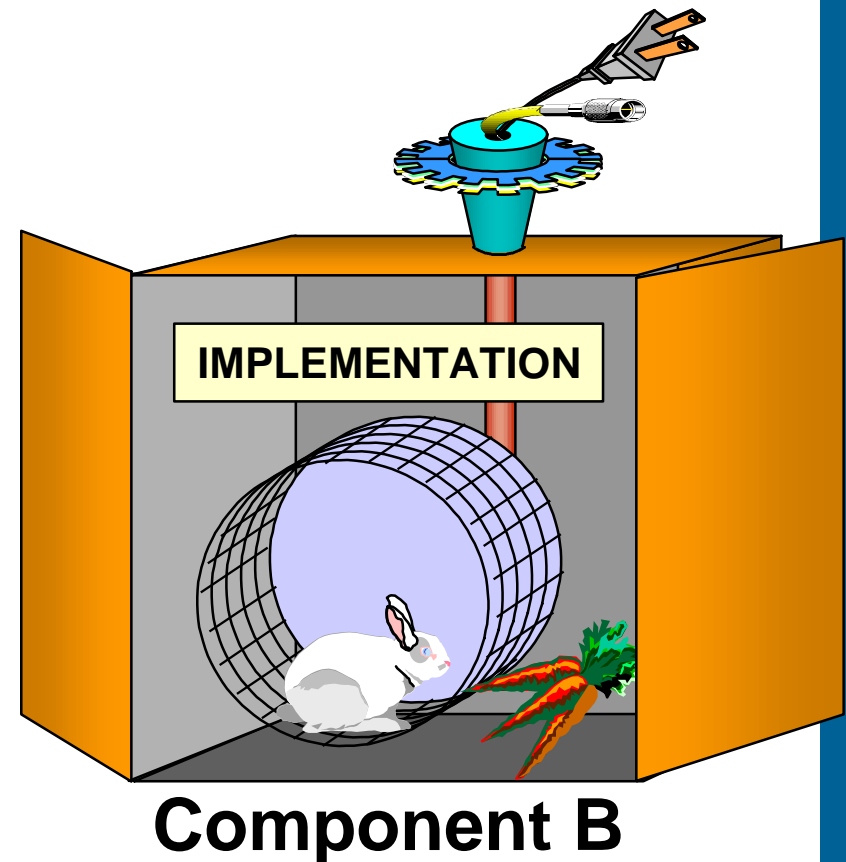
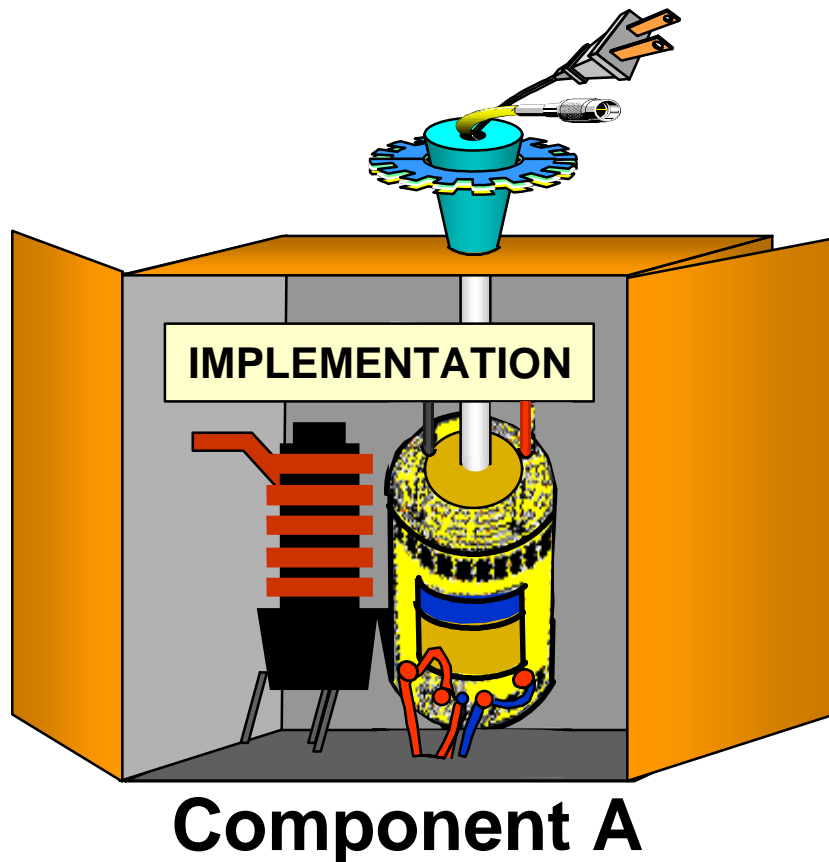
- Completely Defined
- Publicly Available
- Consensus-based



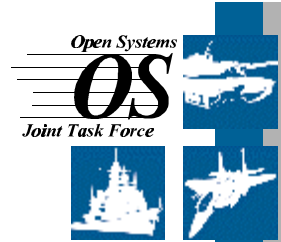
Open interfaces leverage market support

Open Systems Implementations

Developer can choose any implementation to meet interface specification.

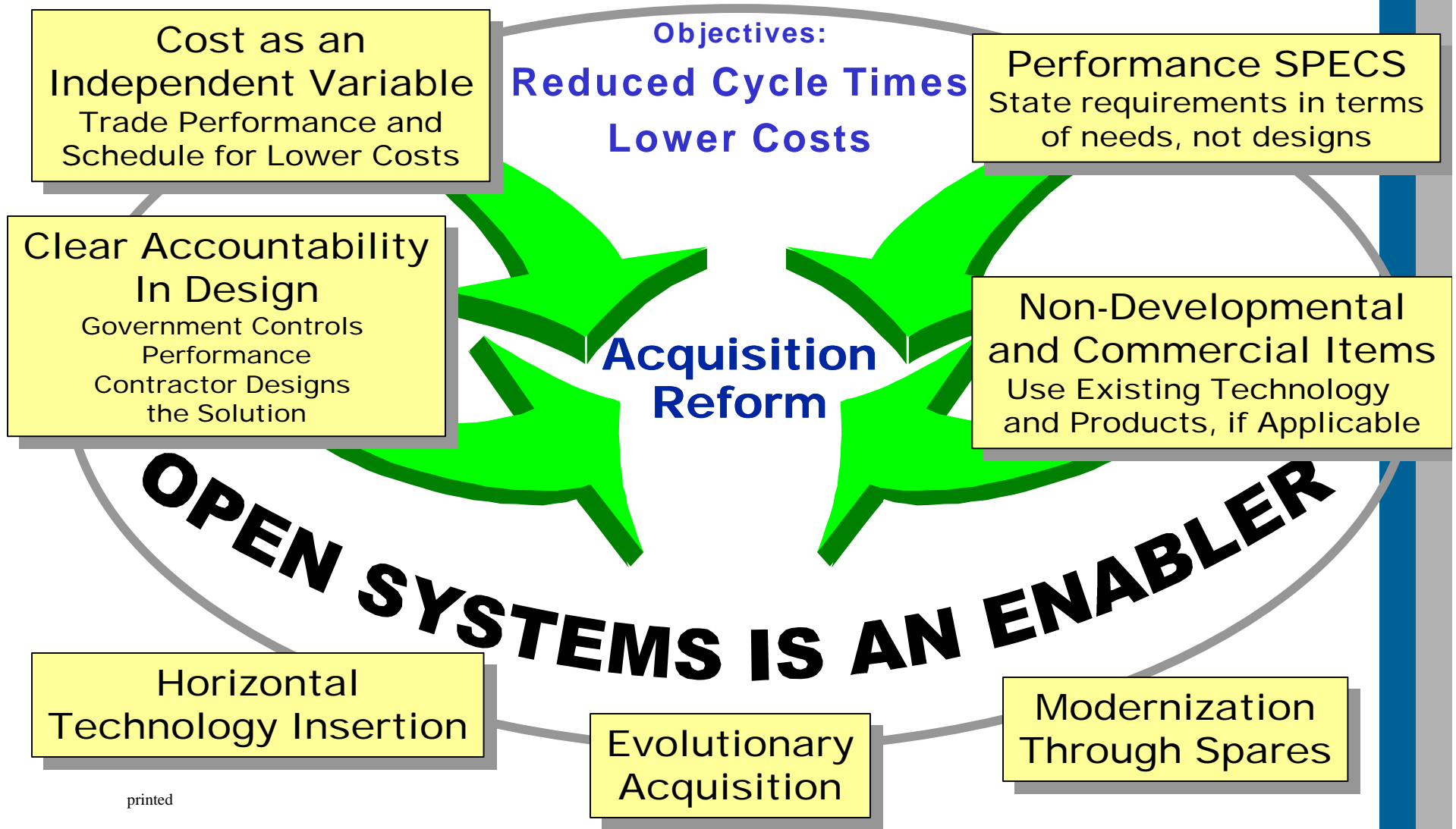


Open System Benefits

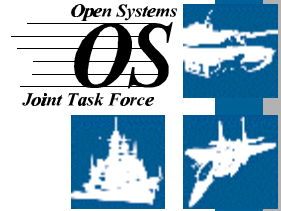


- **Technology Edge**
 - Modernization ease
 - Intra-operability
 - Improved joint operations
- **Lowers Life Cycle Costs**
 - Independence from proprietary components
 - Improve Supply Support
 - Modernization through technology insertion
- **More opportunity for commercial and military companies**
 - Improved international and domestic competition

Relationship to Acquisition Reform



Open Systems Clarification



- Open Systems ¹ Commonality

- Open Systems ¹ COTS

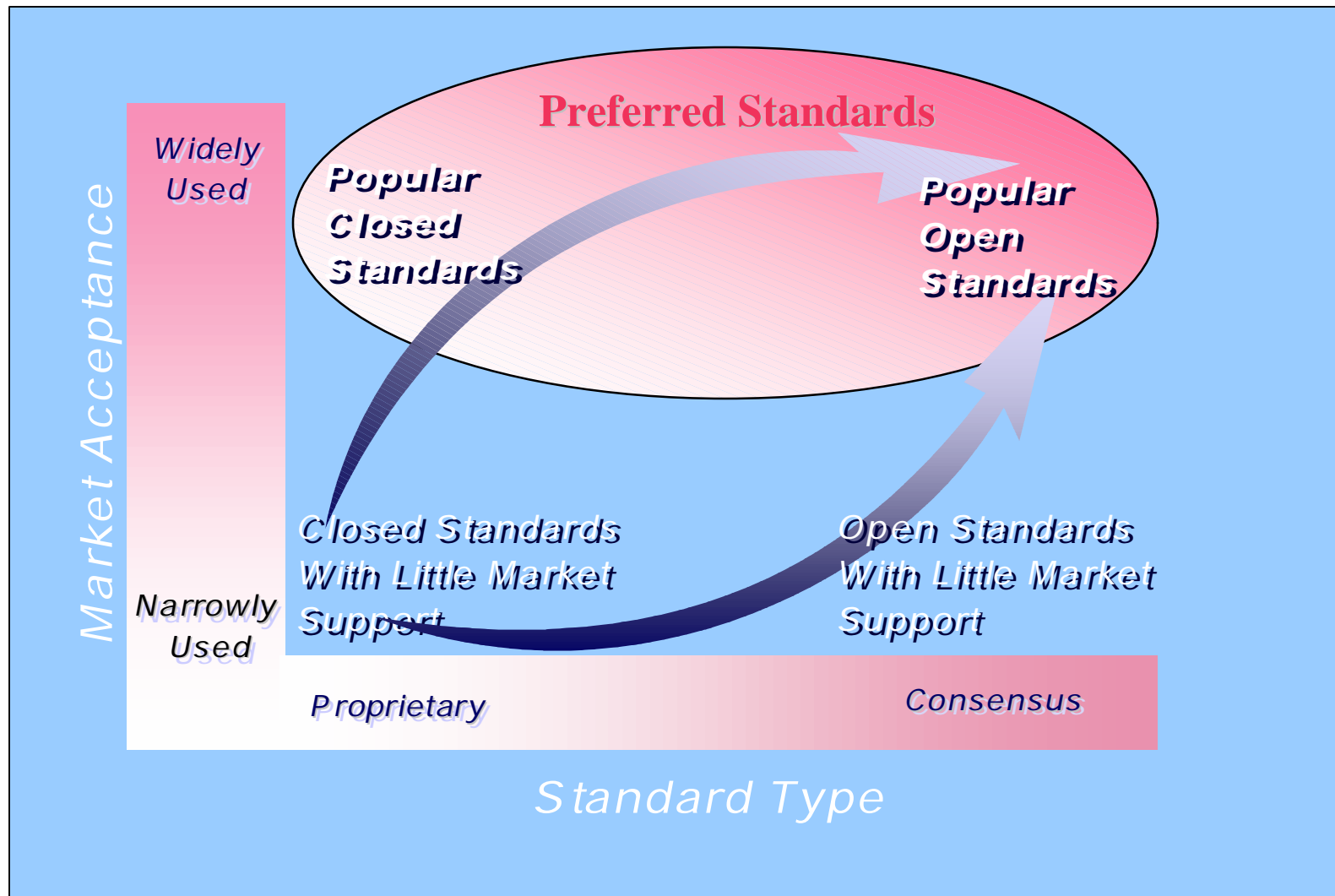
- Open Systems ¹ F ³

- Open Systems ¹ Modular

} Necessarily

- Open Systems = A design based on non-proprietary interface standards broadly accepted and used throughout industry

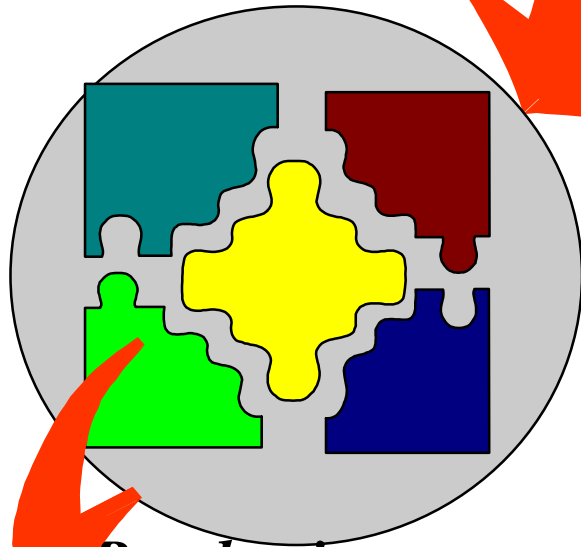
Preferred Standards



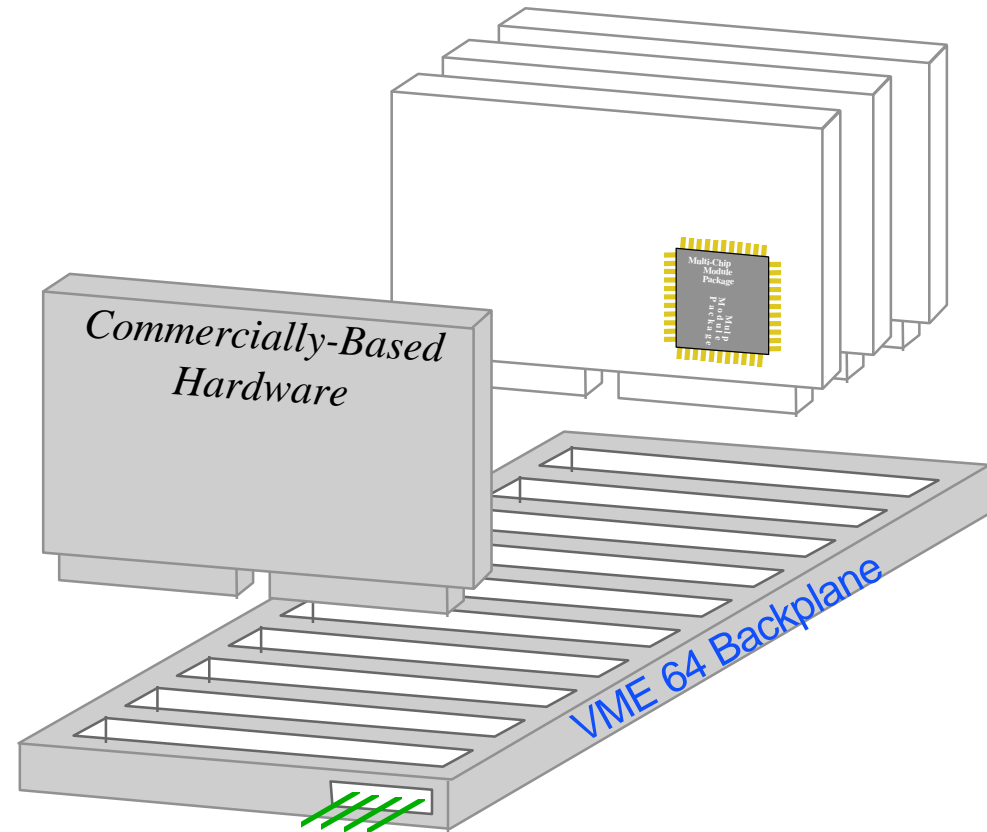
Open Systems Concepts— Modular Design with Open Interfaces



*The circle
represents the
weapons systems*

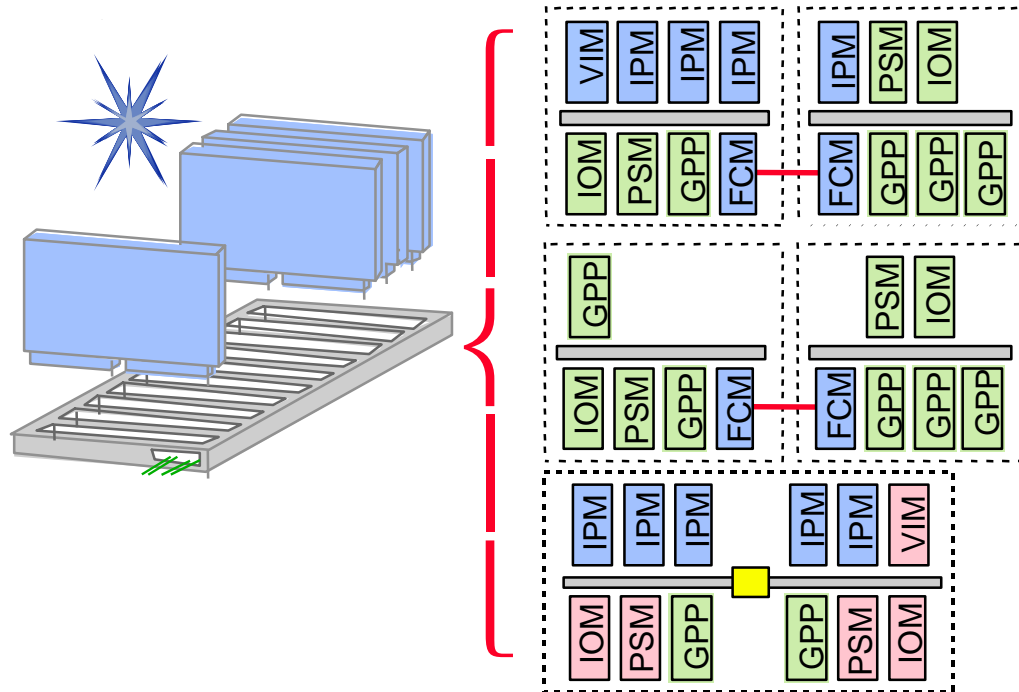


*Puzzle pieces are
components or modules*

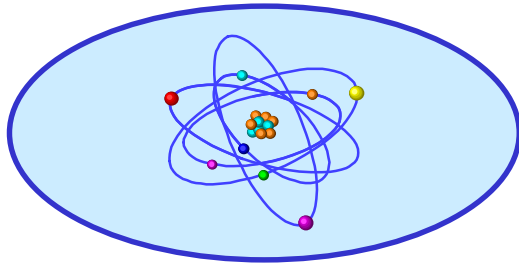


Modular design minimizes dependencies between components to minimize future reengineering and testing.

Modularity & Open Interfaces



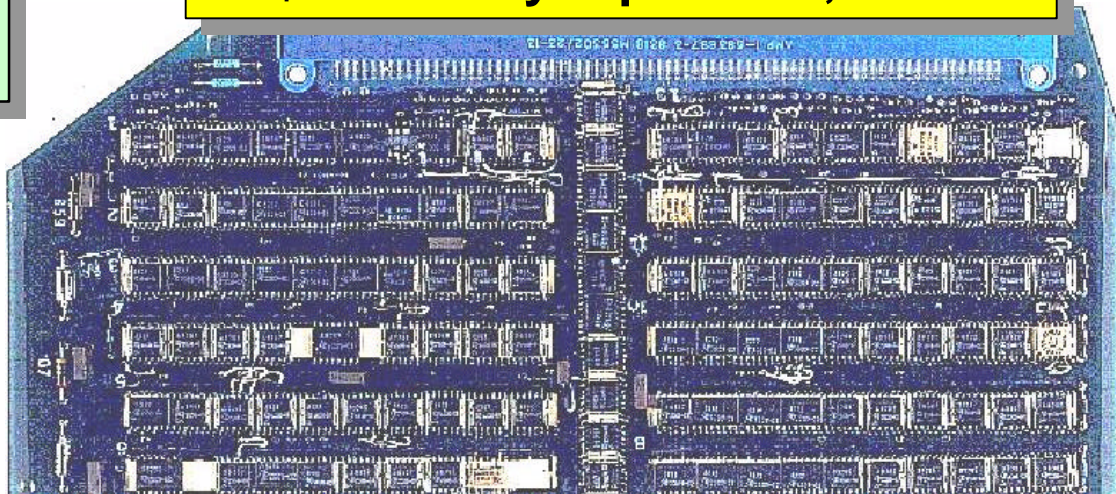
Level of Openness & Maintenance Concept May Change Over Time



\$35K Throwaway, 1985



\$120K fully repairable, 1968

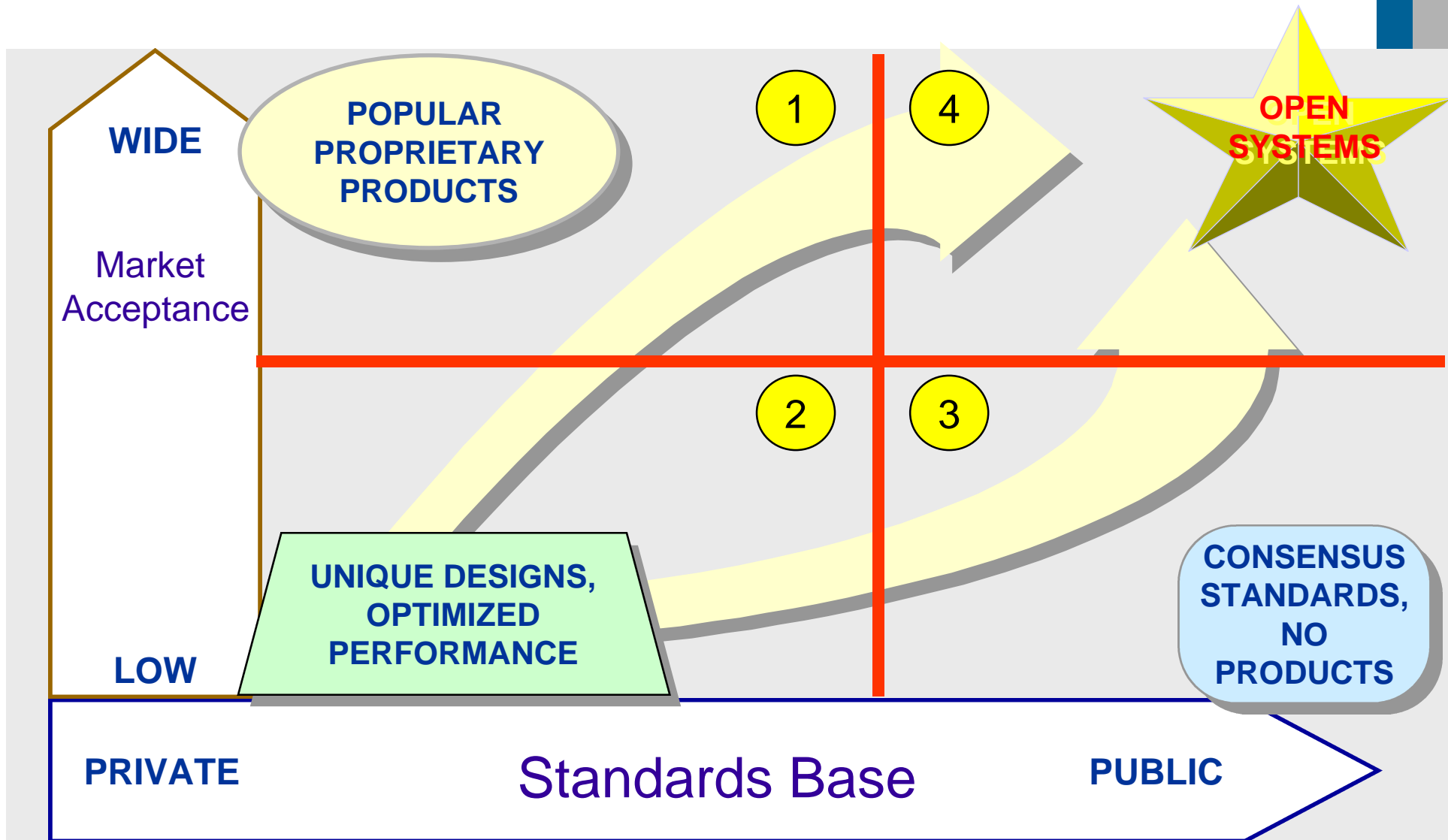
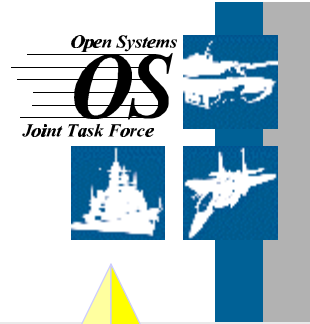


Do you define
Level of Openness
at the **subassembly**,
or on the
individual components?

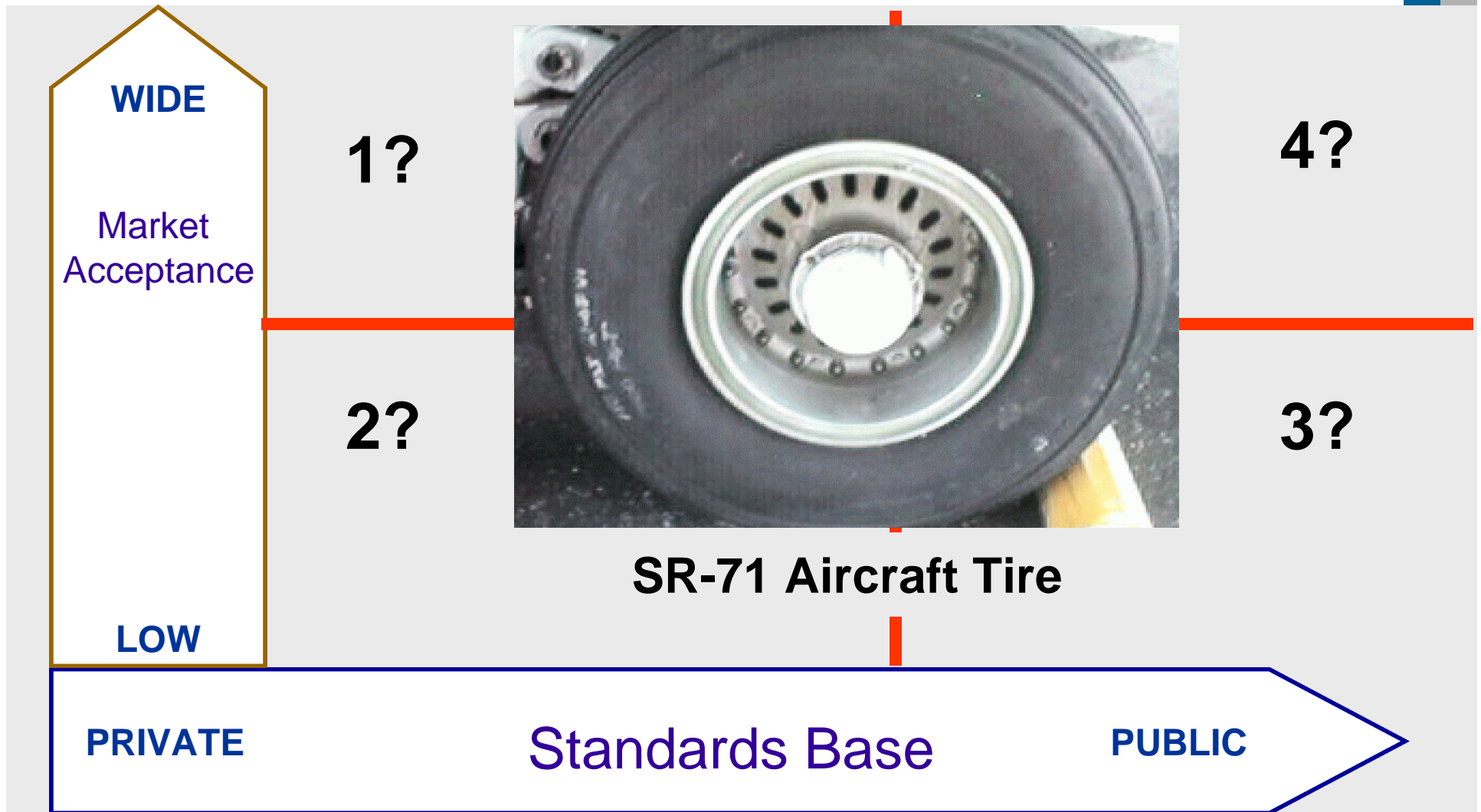
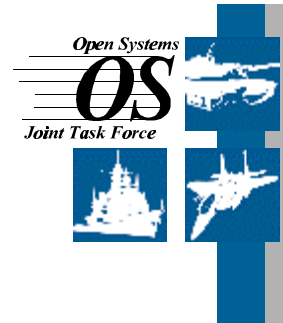
Note that Level of
Openness is not
static -- it can change
over time



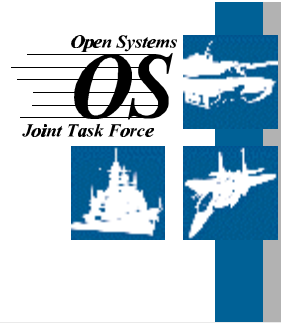
Recognizing Open Systems -1



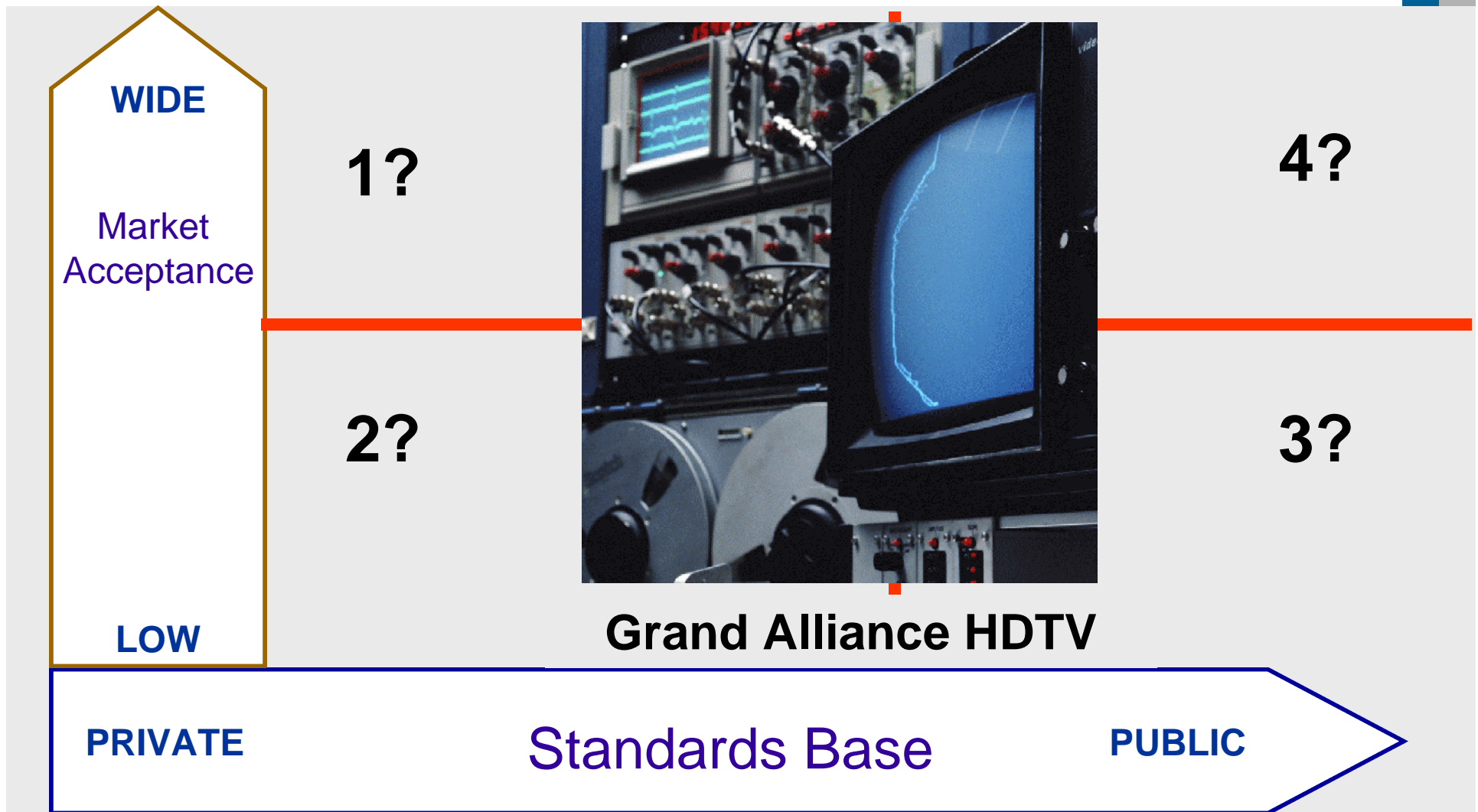
Recognizing Open Systems -2



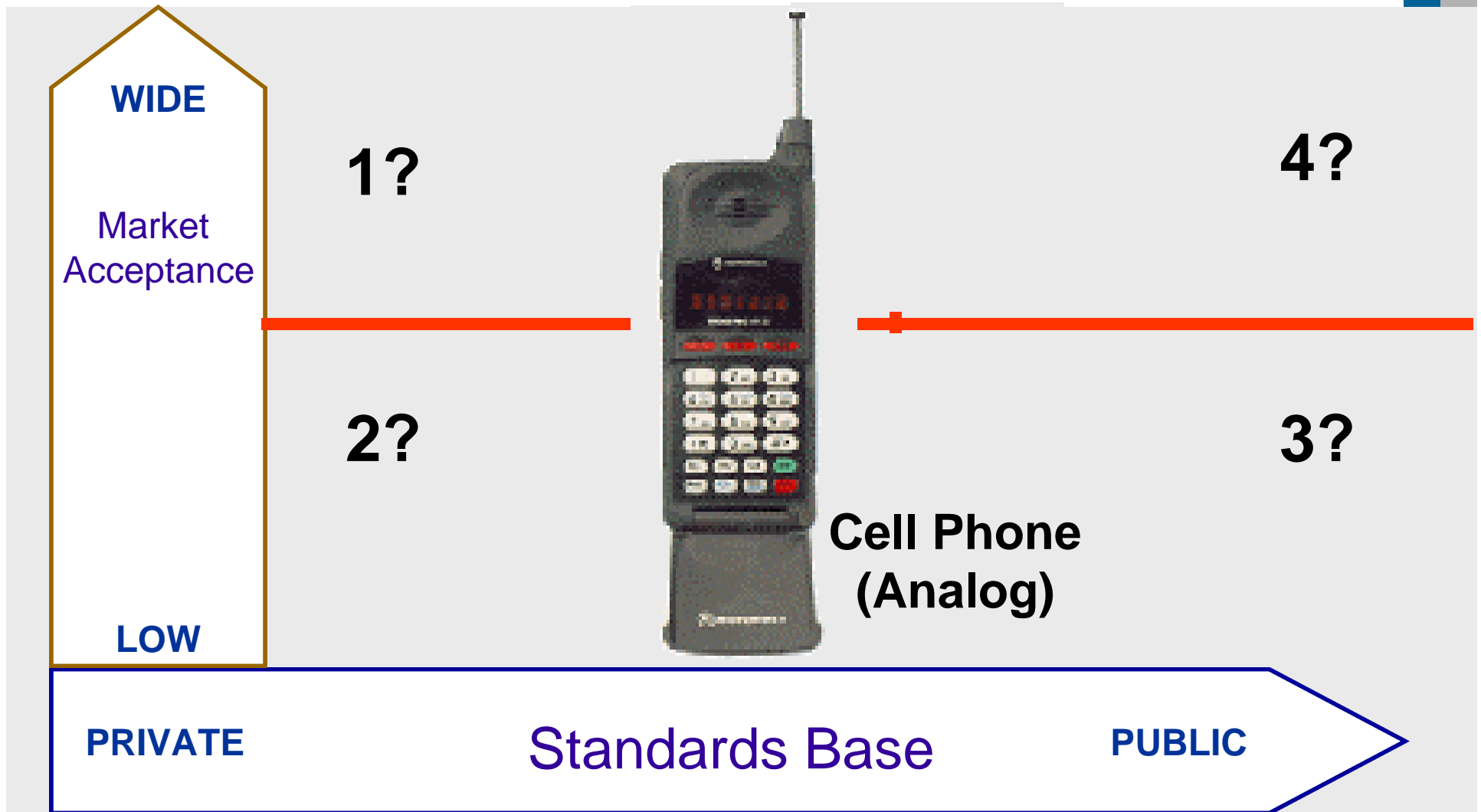
Recognizing Open Systems -3



Recognizing Open Systems -4



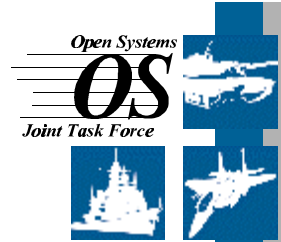
Recognizing Open Systems -5



Management Issues



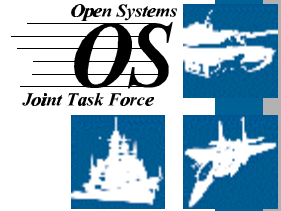
Public Law 104-113



- **With regard to non-government standards, Section 12d states:**

"(1) IN GENERAL. - Except as stated in paragraph (3) [exceptions] of this section, all Federal Agencies and departments shall use technical standards that are developed or adopted by voluntary consensus standards bodies, using such technical standards as a means to carry out policy objectives or activities determined by the agencies and departments.

Public Law 104-113 (continued)



(2) CONSULTATION; PARTICIPATION. In carrying out paragraph (1) of this subsection, Federal agencies and departments shall consult with voluntary, private sector, consensus standards bodies and shall, when such participation is in the public interest and is compatible with agency and departmental missions, authorities, priorities, and budget resources, participate with such bodies in the development of technical standards."

Broad Policy Direction

DODD 5000.1

- **PMs use a modular open system approach as an enabling tool to ensure access to the latest technologies and products, and facilitate affordable and supportable modernization of fielded assets.**
- **Milestone decision authorities use the open system design as a fundamental criterion to commit the Department to the initiation of production.**

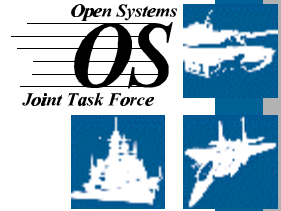
DODI 5000.2

- **The outcome of systems acquisition should be a system that uses open systems design**
- **PMs refrain from early commitments to system-specific solutions that inhibit future insertion of new technology and commercial or non-developmental items**

DOD 5000.2R Mandatory Procedures

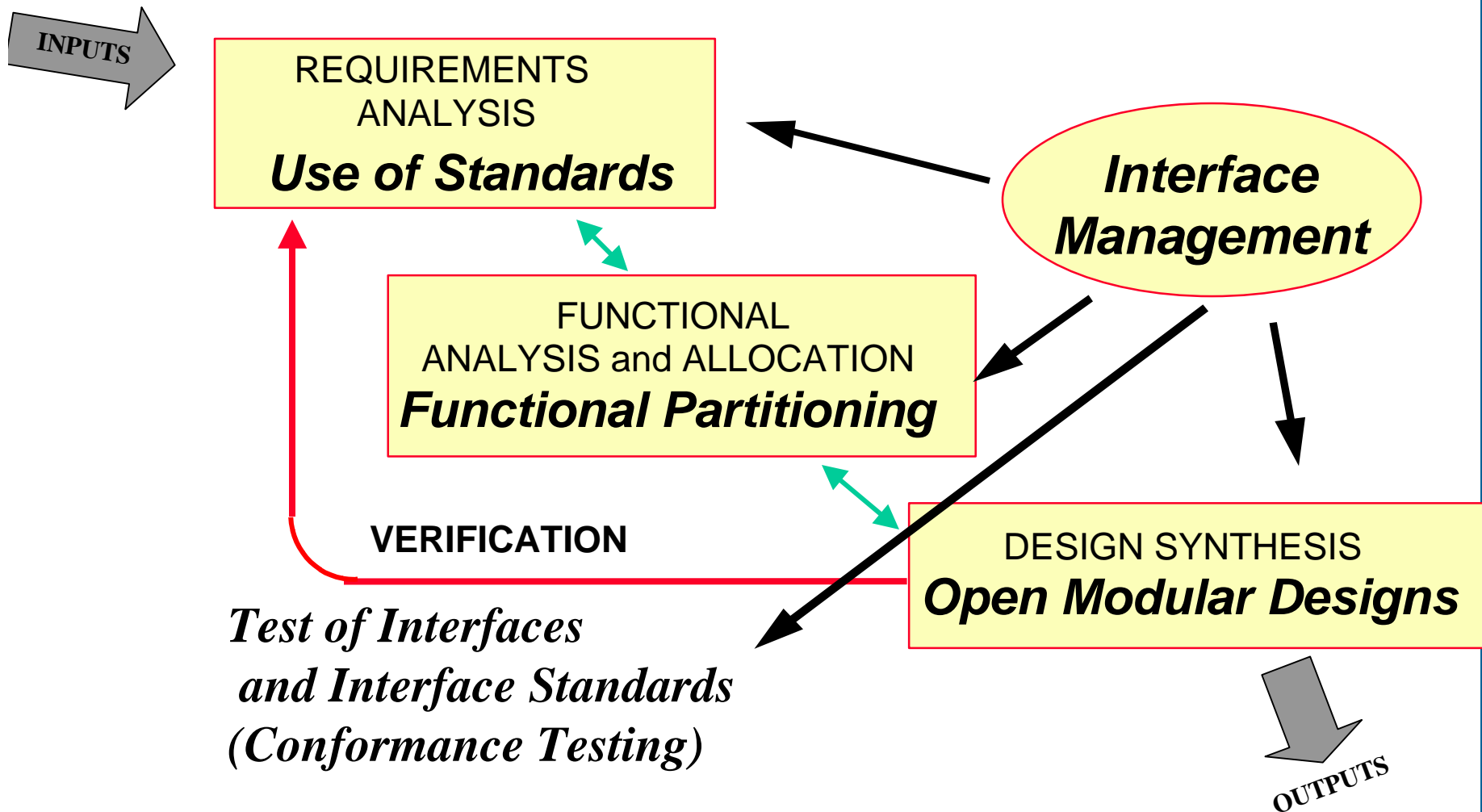
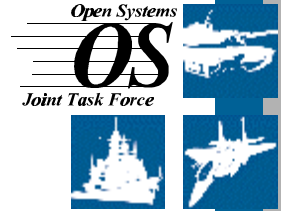
- **Assess the feasibility of using widely-supported commercial interface standards in developing systems**
- **Report on their progress using open standards for key interfaces at both Milestones B and C.**
- **Identify key interfaces and define the system level at and above which these interfaces use various types of standards.**
- **Document the approach for using open systems and include a summary of the approach as part of the overall acquisition strategy.**
- **Use a modular, standards based architecture in design of weapons systems**

Open Systems Engineering Management

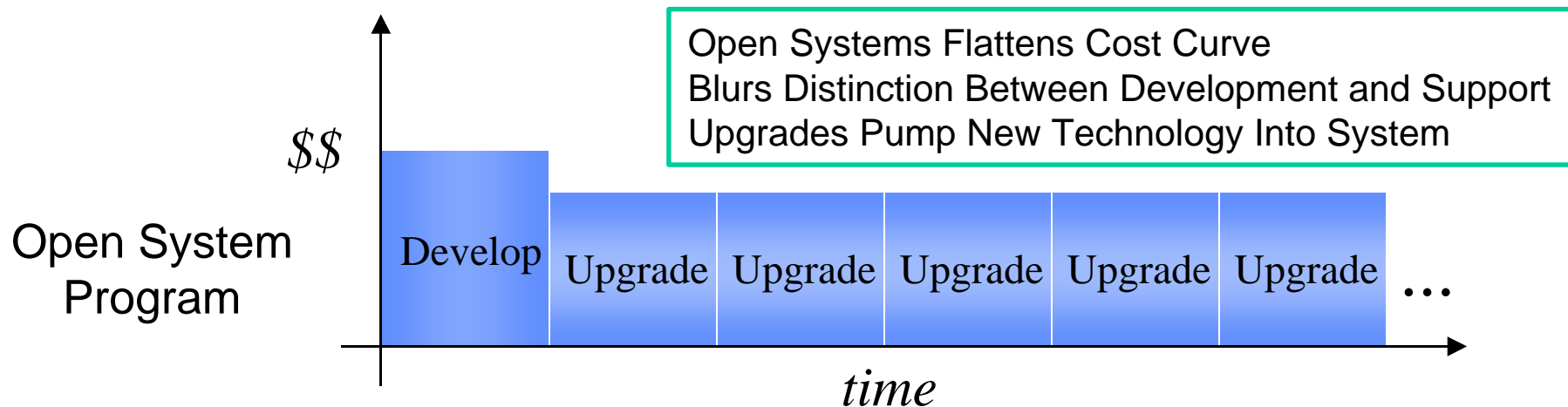
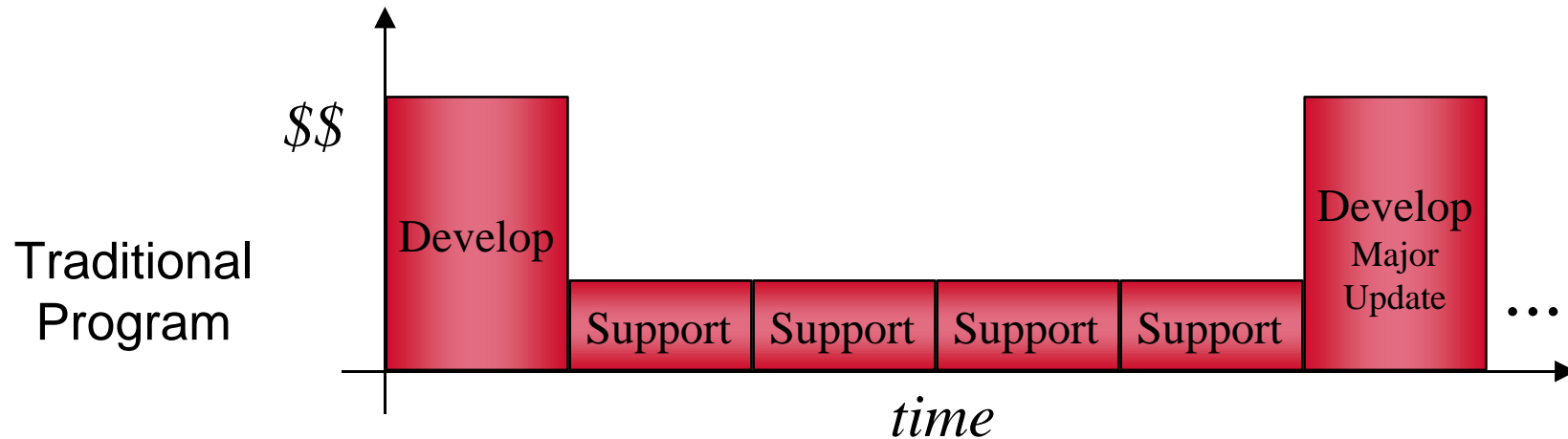


- **Focuses on Design Flexibility to Support Sustainment, Evolution, Upgrade.**
- **Interface *SELECTION* and Control to Enhance Life Cycle Support To Permit Evolution With Technology.**
- **Design for “Change” (Upgrade) Over Time.**
- **Employing Modularity, Based on Well Defined Interfaces, to Isolate Components Likely to Change Over Time.**
- **Multiple Design Solutions Within the Module.**
- **Interface Management Is Key!**

Designing Open Systems Demands the Discipline of the SE Process



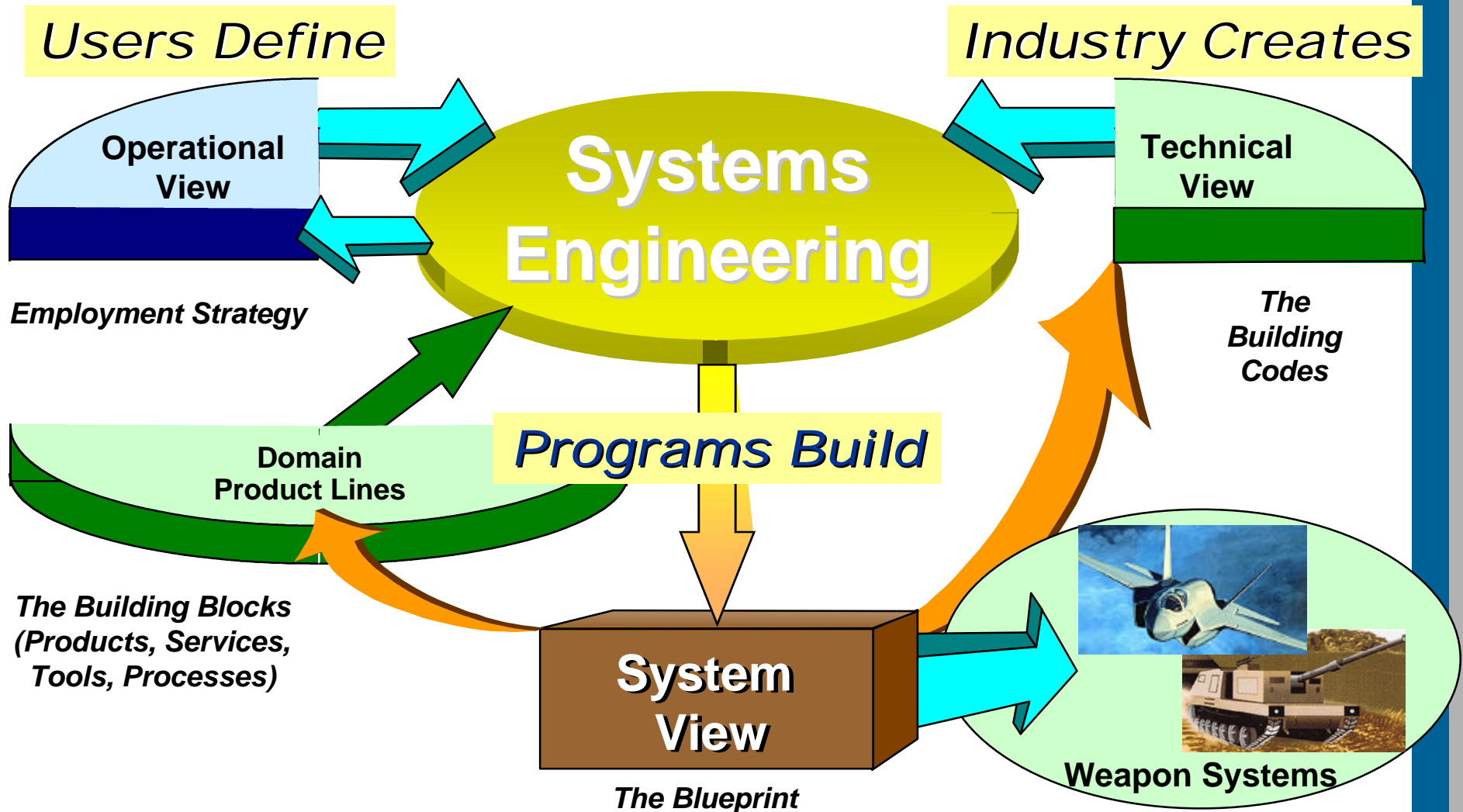
Impact of Open Systems on Budgets





Architectures

Architecture Views



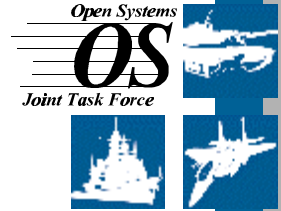
Why a Technical Architecture?

- Guides the selection of widely used, commercially based interface standards necessary for:
 - interoperability of our systems and forces
 - access to rapidly evolving technology
 - access to multiple sources of supply of system components (hardware and software)
 - shorter acquisition cycle, and
 - lower life cycle costs

JTA V 1.0 Philosophy

- **C4I/Information Technology core mandate - Minimum required for interoperability**
- **One standard for each capability/service area**
- **Address beyond C4I/Information Technology as possible**
- **Mandate only stable, mature standards**
- **Includes use of military standards profiles when no commercial standard was identified or suitable for use**
- **No legacy standards included for backward compatibility**
- **Identify emerging standards - for information purposes only**

JTA V 1.0 Standards



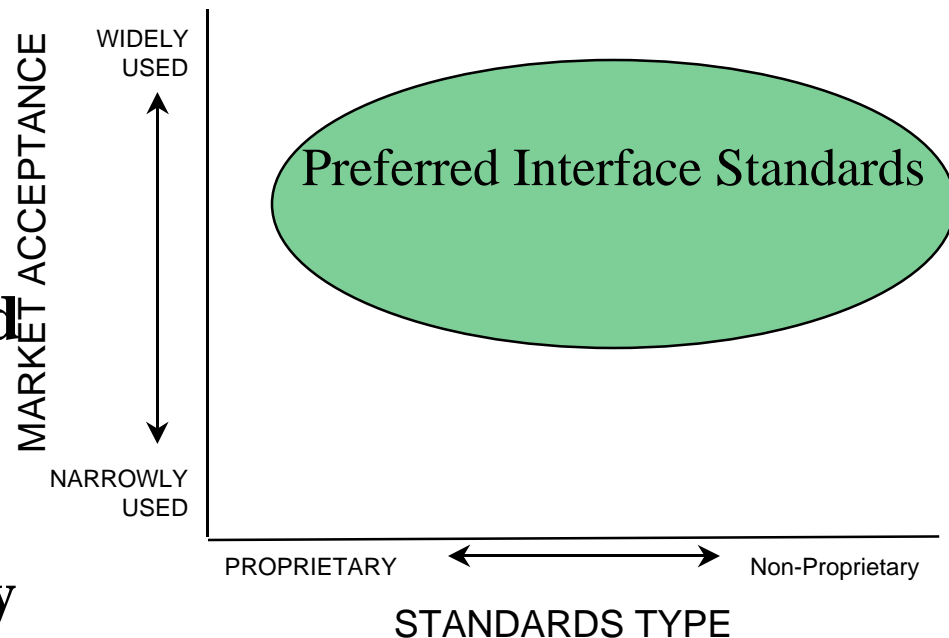
- **Standards should be OPEN:**

- Publicly available
- Completely Defined
- Consensus-based
- Industrially developed
& controlled

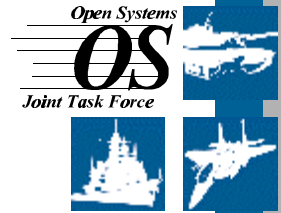
- **Order of Precedence**

- International industry
- National industry
- Government
- Military

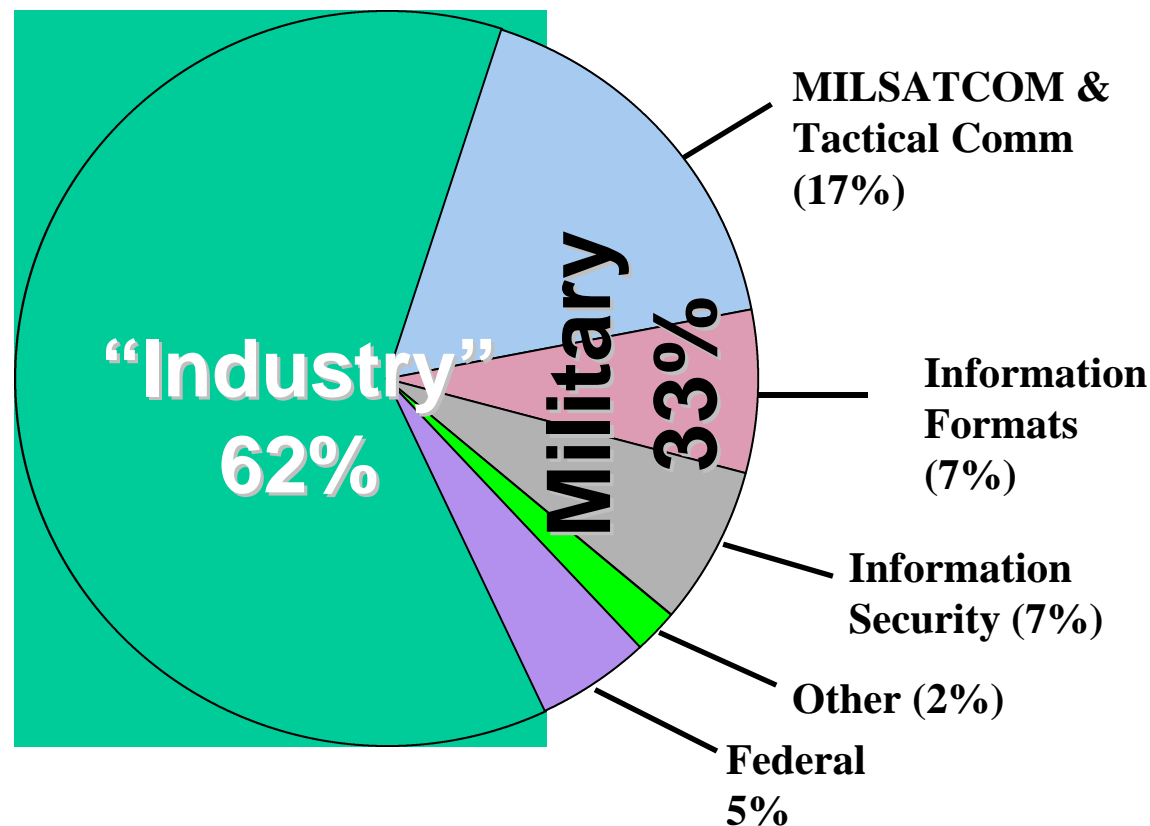
OPEN SYSTEM INTERFACES



JTA is Consistent with DoD Guidance on Specifications & Standards

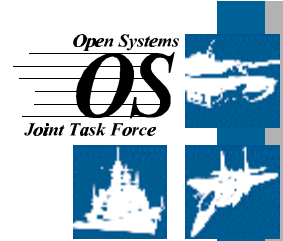


Of Approximately 160 Standards:



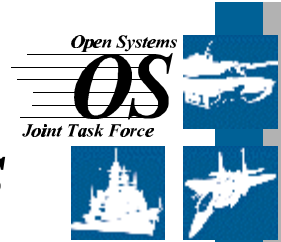
JTA facilitates use of Commercial Specifications and Standards

JTA Evolution - Ver 2.0 Philosophy



- To go beyond C4I “skin-to-skin” interoperability
- To achieve affordable interoperability
- To expand scope to include standards for sustainment, weapons systems, modeling & simulation
 - “Pathfinders”
 - Modeling and Simulation High Level Architecture
 - Airborne Reconnaissance Information Technical Architecture
 - Automatic Test Systems Critical Interfaces
 - Army Technical Architecture weapons systems standards - including Aviation, Ground Vehicle, Soldier System, and Missile domains

Committee on Open Electronics Systems (COES) Observations & Recommendations



- Findings
 - No Single Set of Standards Appropriate for all DOD Weapons Systems (Beyond those required for interoperability in the JTA)
 - Identified Technical Architecture Pathfinders
- Recommendations
 - Developed Weapons Systems Domain Approach
 - Proposed Ten Weapons Systems Domains
 - Proposed Weapons Systems Domain “Technical Architects”
 - Technical Architectures should be Established by Existing Bodies Where Possible [esp. Tri-Service]
 - Technical Architectures should be Established in Partnership with Industry

COES Proposed Functional Domains

Weapons 4ISR

- Command and Control
 - Communications
 - Intelligence
 - Information Warfare
-
- Surveillance/Reconnaissance
-
- Aviation
 - Space Vehicles
 - Maritime Vessels
 - Ground Vehicles
 - Automated Test Equipment
 - Missiles
 - Missile Defense Systems
 - Munitions
 - Soldier Systems

Sustainment Base

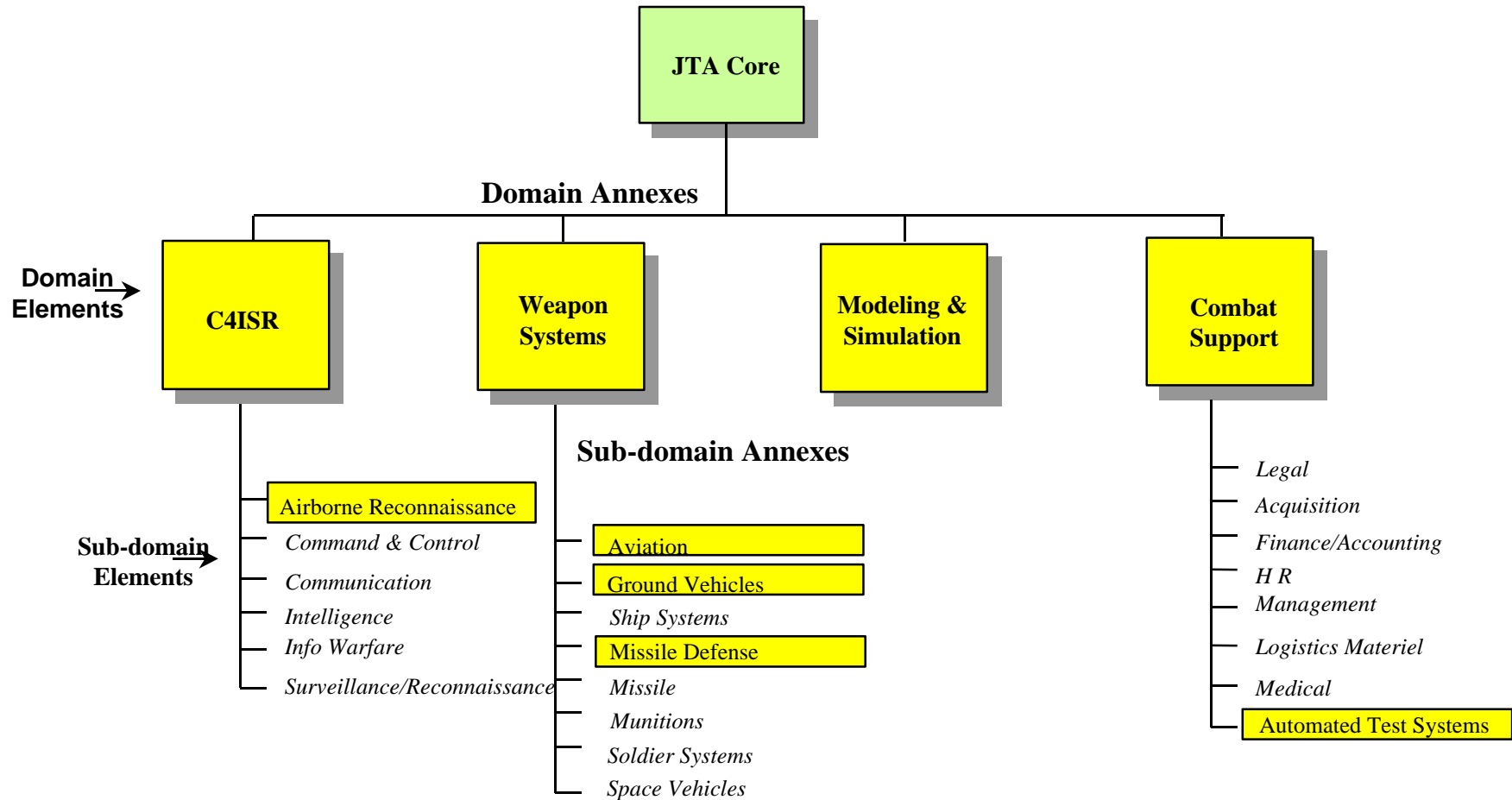
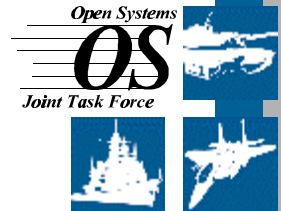
- Human Resources Management
- Medical
- Finance and Accounting
- Logistics and Materiel
- Acquisition
- Legal
- Mapping

M&S

- Training Devices
- Simulators and Test Beds
- Analysis and Wargaming

Several Dependent/Independent Domains

JTA Ver 2.0 Structure



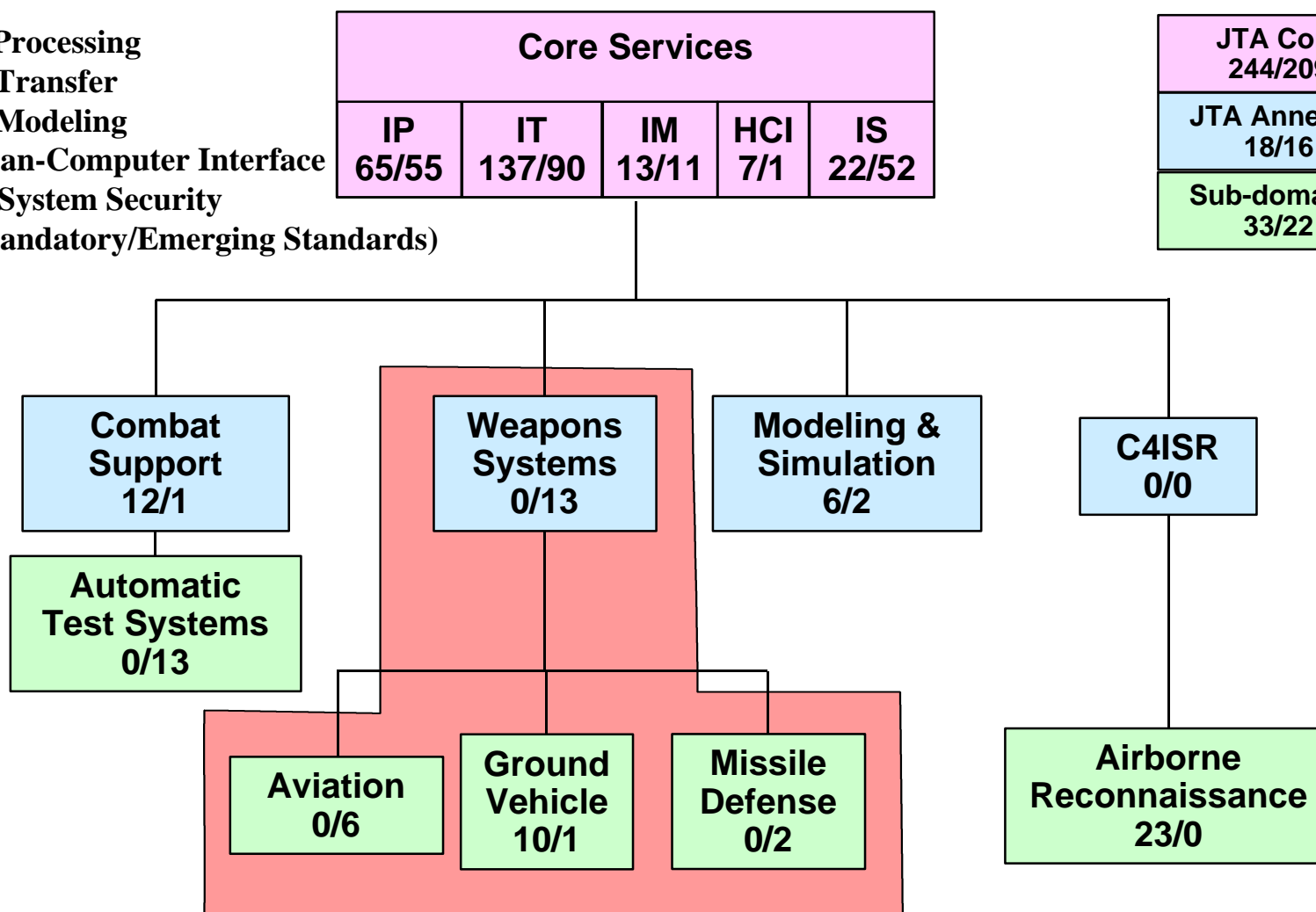
JTA Ver 2.0 Content



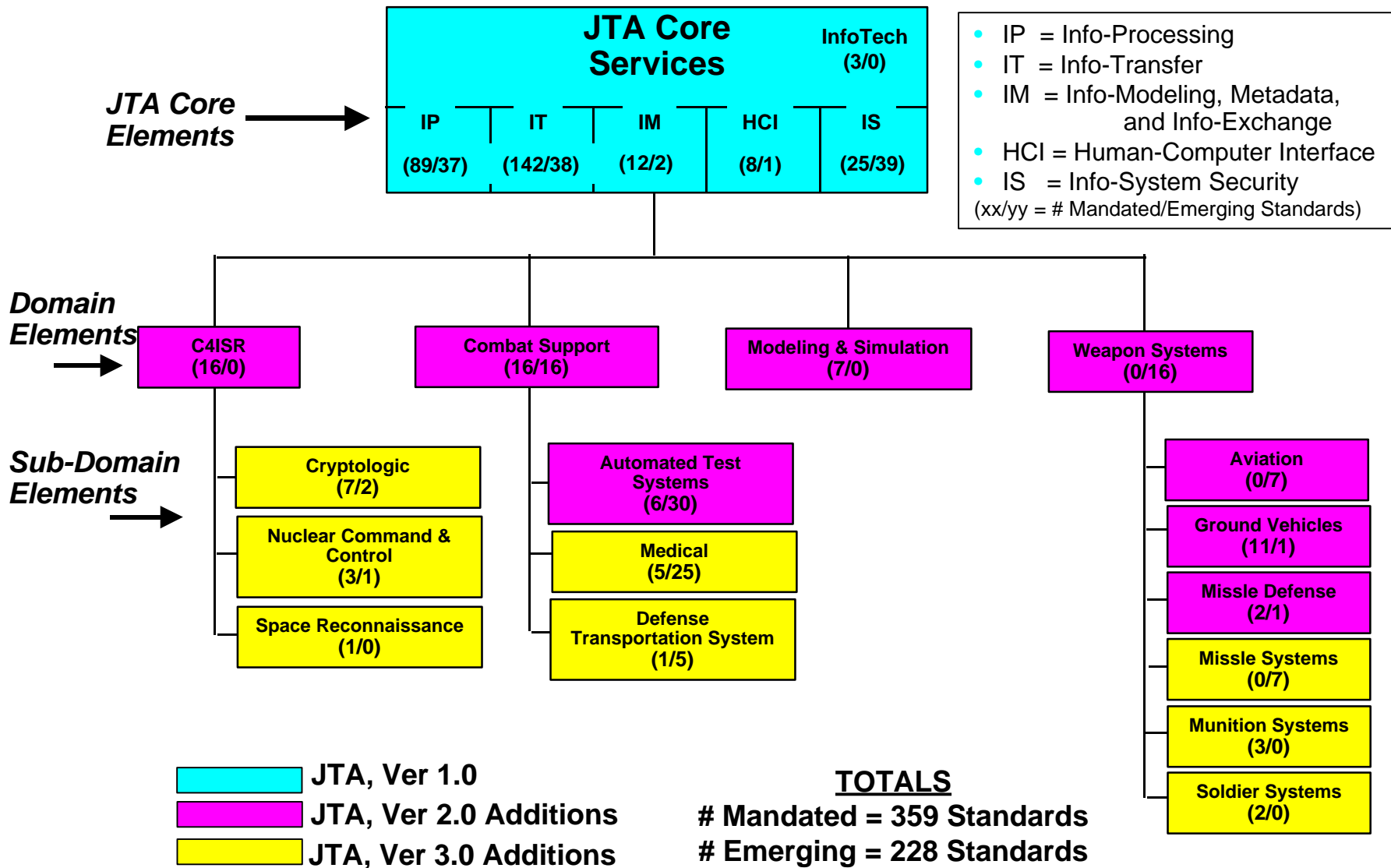
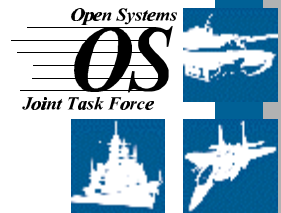
Summary

JTA Core 244/209
JTA Annexes 18/16
Sub-domains 33/22

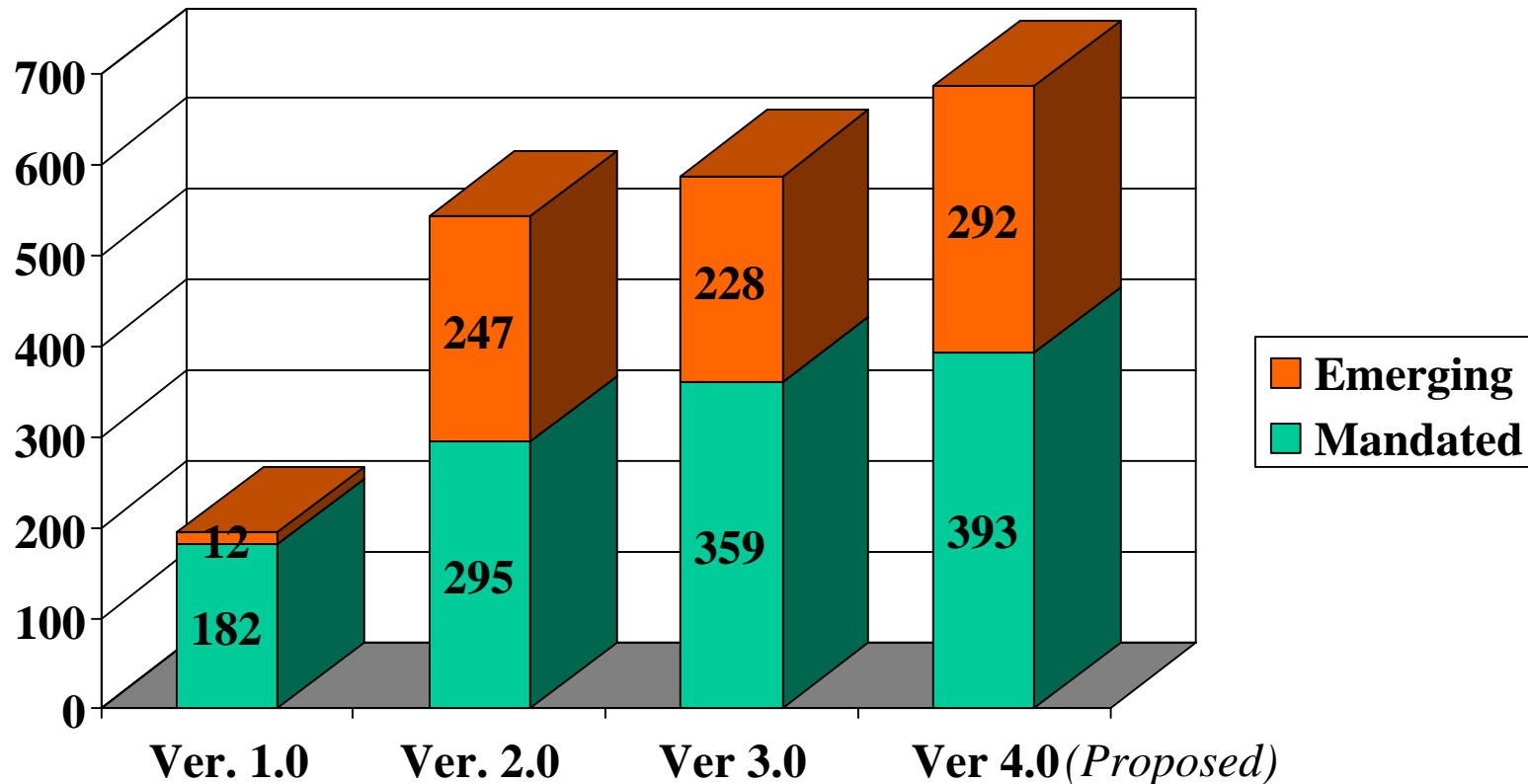
IP = Info Processing
IT = Info Transfer
IM = Info Modeling
HCI = Human-Computer Interface
IS = Info System Security
 (xx/yy = #Mandatory/Emerging Standards)



JTA Version 3.0



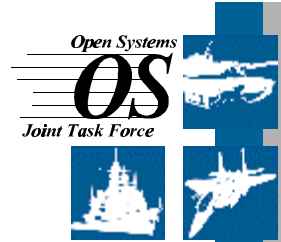
Growth of JTA Standards



350% increase in number of standards from versions 1.0 to 4.0
Result: significant increase in complexity for program manager



Architecture Coordination Council (ACC)



Chairs

ASD(C3I)

JS/J6

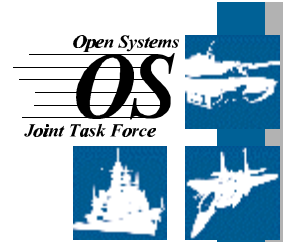
USD(A&T)

Membership

- DDR&E
- ASA(RD&A)
- ASN(RD&A)
- ASAF(ACQ)
- USMC(ACS(C4I))
- DASD(C3)
- DS&TS
- DUSD(LOG)
- DUSD(AT)
- DISA
- DIA
- NIMA
- NSA
- BMDO
- ISS
- NRO
- DUSD(SPACE)
- SOCOM
- JS/VD(C4)

**Weapons Systems stakeholders have poor representation
in Architecture coordination & development**

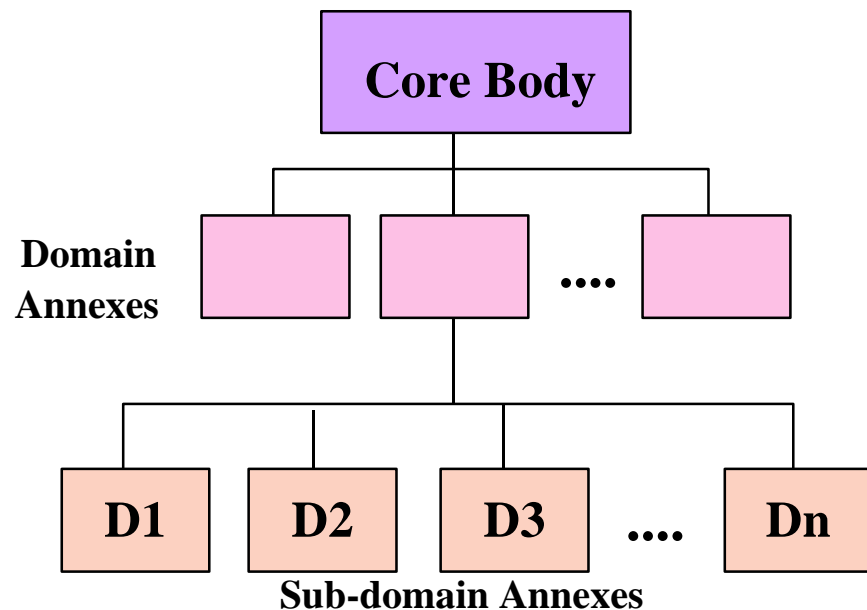
Issues Associated with the JTA 2.0 Extension Process



- Addition of domain annexes increases size and complexity of document
- No single way to defined and partitioned domains
- The relationship between domains may be complex
- Usage when domain guidance conflicts with the core
- Systems don't always align with a single domain
- Non-domain stakeholders can influence the content of that annex
- Domain stakeholders give up ownership of their content
- No means to update portions of the JTA in an asynchronous and distributed manner
- No means to include 'preferred' or non-IT standards
- Participation and representation predominately from C3I community

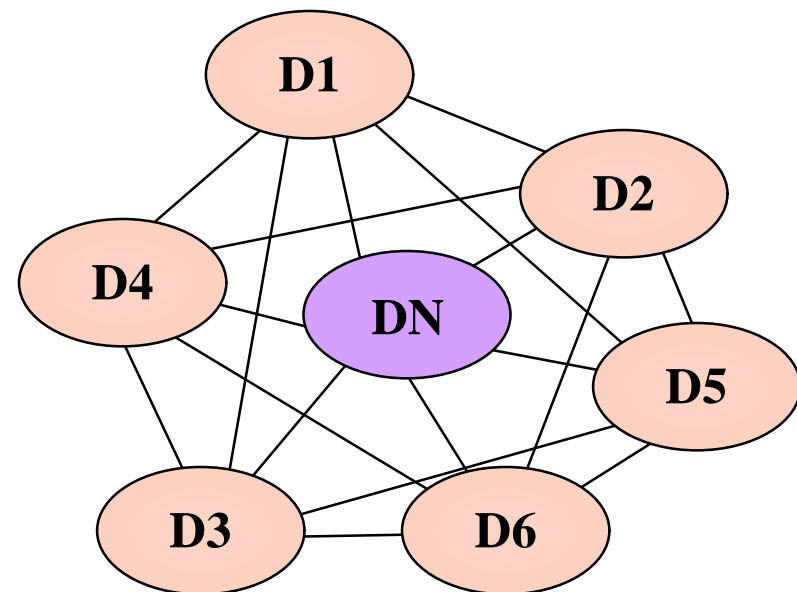
Revised Structure is Needed

JTA 2.0 *Hierarchical*



- Lengthy update cycle
- Domains don't match systems
- Difficult to use
- Increasing size & complexity
- Central CM

Future *Distributed*

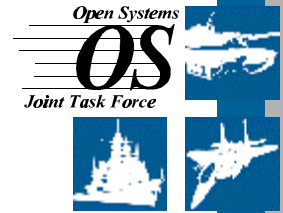


- More timely
- More flexible
- More user friendly
- Paperless
- Distributed CM



Program Benefits

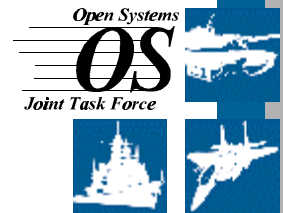
A Warfighter's Perspective



“... the Advanced Display Core Processor is estimated to save \$100M O&S. A significant portion of the estimated cost savings is due to object oriented software and associated reductions in integration/flight testing... because the ADCP will be of an open systems architecture design, the risk of future redesign due to out of production parts will be mitigated.”

~ John W. Hawley, Major General, USAF
Director of Requirements, Air Combat Command
12 March 1997 Memo to DARPA JDUPO

Health and Usage Monitoring System (HUMS) for Rotary Wing Aircraft



Objectives:

- Use embedded OS-based sensors and diagnostics to predict maintenance problems
- Apply to a wide range of vehicles

Performance:

- Avoid catastrophic failure
- Enable operator efficiencies through common cockpits
- Achieve a scalable architecture through OS

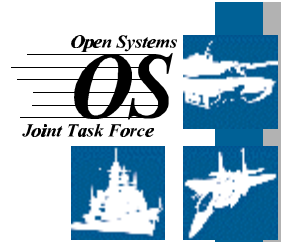
Cost:

- \$450K OS-JTF investment
- Anticipate \$22M in program cost reductions through O&S
- Projected reductions in downtime, maintenance, and O&S costs

Benefits:

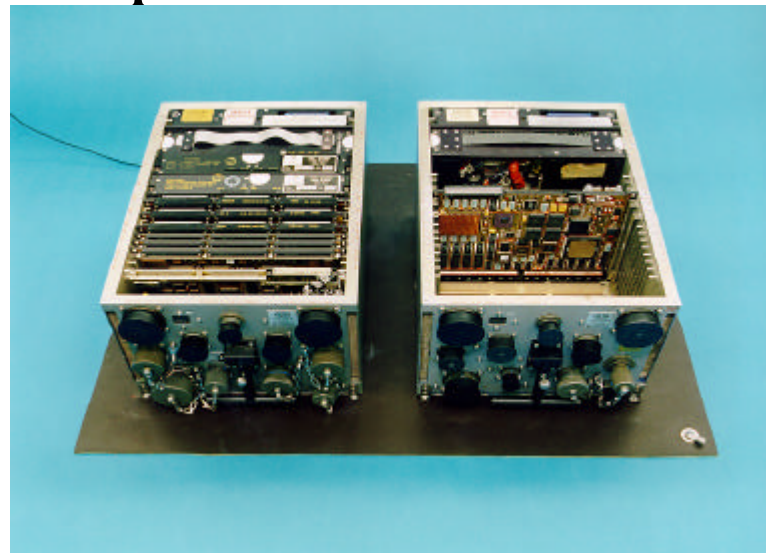
- Improved aircraft safety
- Avoid technical obsolescence
- Achieved common cockpit
- Improved technology insertion and refresh
- reduced O&S manning and training infrastructure

AV-8B Open Systems Hardware Architecture



- Open Systems Approach
 - Commercial-based HW
 - VME 6U module card
 - Motorola Power PC processor

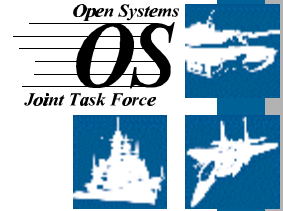
Hardware and software upgrades to AV-8B Harrier II keep it operationally effective through 2015. (Mission systems computer)



Challenges and Summary



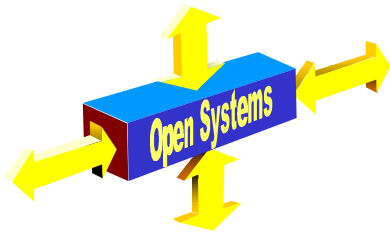
Open System Challenges



- **Testing philosophy must evolve to accommodate rapid change**
- **Logistics approach must change**
- **Must “care and feed” system interfaces - this is not an option**
- **Configuration management may be complex but is absolutely essential**
- **May cost more up-front**
- **Government must participate in industry standards groups**
- **Validation of compliance and/or conformance to standards**
- **Impacts on the way industry currently does business**

Key Points on Open Systems

- **How to:**



- **leverage the commercial market place**
- **incorporate emerging technology**
- **ensure modernization**
- **control cost**
- **manage risk**
- **plan logistic support**

What provisions have been made in your program to ensure the widest range of suppliers will have the opportunity to offer their products throughout the program life cycle?

A large ship is sailing on the ocean at sunset. The sun is low on the horizon, creating a bright reflection on the water. The sky is filled with clouds, and the overall scene is peaceful and scenic.

Questions